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Agriculture

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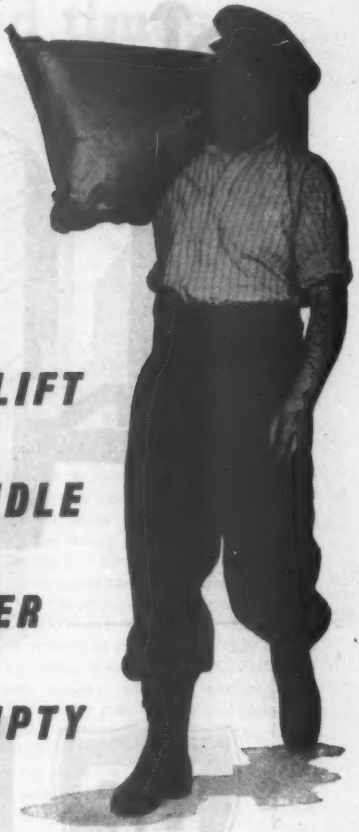

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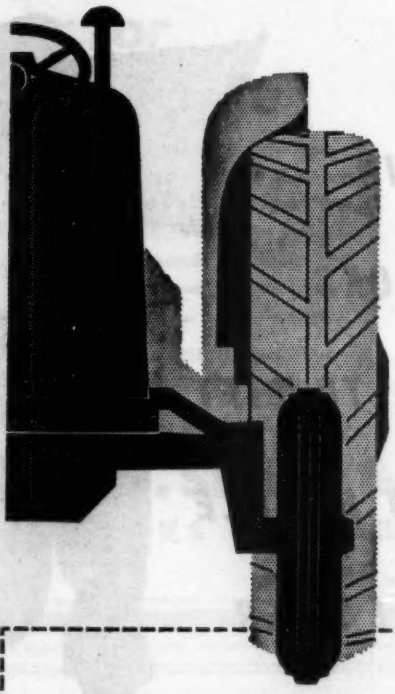

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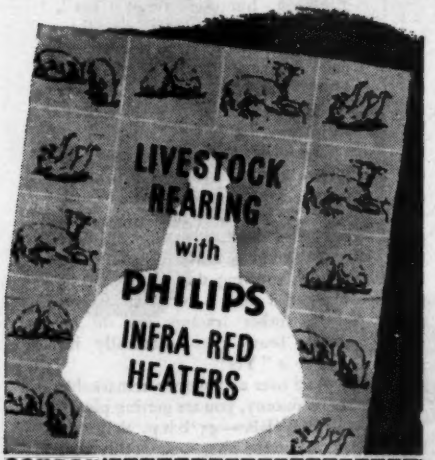

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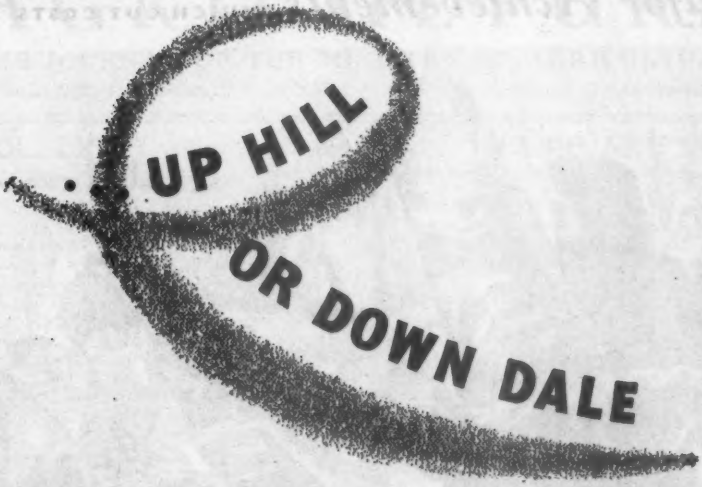

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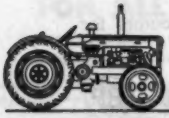

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VOL. LXI No. 11 FEBRUARY 1955

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Contents

	Page
Labour Productivity in Horticulture. *L. G. Bennett*	515
Engineering Developments in the Glasshouse Industry. *G. P. Shipway*	520
Problem of the Small Upland Dairy Farm. *J. Tasker*	524
Improvement of a Somerset Estate by Ley Farming. *George Jarrett*	530
Feeding this Winter	533
The Agriculture of the Netherlands. *Ronald Ede*	534
Clun Forest Farm: Progress Report. *David R. Browning* and *H. Harland* ...	538
Longwools and Half-breds Compared at Bicton. *S. Barratt* and *Gordon Salmon*	543
Interaction of Nitrogenous Fertilizer and White Clover in Ungrazed Swards. *J. D. Ivins* and *G. W. E. Fernando*	549
The Cattle of Britain: 21. Highland. *D. G. Noble*	553
Farming Affairs	555
Book Reviews	559

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Winter hay on a West Riding farm.

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LABOUR PRODUCTIVITY IN HORTICULTURE

L. G. BENNETT, PH.D.

Department of Agricultural Economics, University of Reading

The Department of Agricultural Economics at Reading is studying ways of increasing the productivity of labour in horticulture, using a grant from Conditional Aid Funds to finance the inquiry. This article is in no sense a report on the work being done. It does, however, indicate the lines of inquiry which are being followed, and may well foreshadow the conclusions which will be reached as a result of systematic research.

THOSE who have to manage any kind of horticultural or agricultural business must, in times like the present when labour is becoming increasingly expensive, be concerned with the level of productivity of the staff they employ. The financial success of any enterprise depends to a very great extent, in fact, on the attainment of a high level of labour productivity. This article is presented with the object of showing which factors influence the volume of productive effort that a given labour force can achieve, and of discussing some ways and means of removing those hindrances to high labour productivity which are known to exist on many horticultural holdings.

Before going on to do this, however, it is necessary to do three things. First, to show how difficult it is to define productivity in terms which are precise and which also mean something to the grower. Second, to show how circumstances in horticulture and in agriculture differ and how these differences make a useful calculation of productivity in the former more difficult than in the latter. Third, to suggest some standards by which growers can judge the productivity of their own staffs, and to show how these standards are related to actual conditions in horticulture.

Ideally, labour productivity should be expressed in terms of the weight, volume or number of units of the product for a given cost of labour in a given period. There is, however, no common measure in physical terms which will embrace such diverse products as cabbages and carnations, peas and peaches, or tomatoes and turnips. The only common factor is their money value, and the only way in which labour productivity can be expressed for the holding is in terms of the relationship between labour costs and the money value of its product.

This immediately brings into prominence the second difficulty that the grower, unlike the farmer, cannot be certain, within limits tolerably narrow for the purpose, of the price his produce will fetch on the market. For this reason, there is a lack of coincidence between quantity and value, and value appears to be a rather unsatisfactory measure of productivity. Even so, it

is a more satisfactory measure than appears at first sight—for two reasons. The first is that where a number of crops are grown, the imperfections tend to be minimized by the "swings" making up for the "roundabouts", and vice versa. The second and more important reason is that manual effort in horticulture must be directed not only to producing as heavy a crop as possible, but also to producing it at the time when prices are relatively high. The value of the product therefore measures the effectiveness of the effort which has gone to producing it, and is thus by no means an unsatisfactory yardstick to use in horticulture, though it will be measuring at the same time the efficiency of the management. On a great many horticultural holdings, of course, the management and the bulk of the manual labour are provided by one and the same person.

Labour Costs as a Yardstick Where, then, does the grower cut the notch on his yardstick before measuring the efforts of his labour force? Clearly, if the measure of labour productivity is the percentage which labour costs form of the value of the net output, then in years when prices are good the standard must be higher than in years when prices are low. In practice, however, this refinement is hardly called for, because one of the striking features of the horticultural industry is the very great difference in productivity measured in this way, as between different holdings in the same year.* Some figures from twenty-seven market gardens in the south of England, given in Table 1, illustrate this point.

Table 1

Distribution of Twenty-seven Market Gardens with Different Levels of Labour Productivity in 1952-53

Labour Cost† as Percentage of Net Output	Number of Holdings	Number with Profits	Number with Losses
Under 30	3	3	—
30-40	7	7	—
40-50	8	8	—
50-60	5	3	2
Over 60	4	—	4
	27	21	6

†Labour cost includes the value of unpaid family labour.

The best performance was put up by a holding with a figure of 24 per cent, and the most unprofitable holding had labour costs of 200 per cent of net output. It is noteworthy that in the data given above losses appear when the figure of 50 per cent is exceeded, and in most years the market gardener should aim to keep his labour costs below 50 per cent of his net output, or, in other words, his labour force should produce not less in value than twice its cost. The fruit-grower should aim at a figure of not more than 40 per cent, and the glasshouse grower a figure of not more than 30 per cent, because in these two forms of enterprise costs other than labour costs assume greater importance than they do in market gardening.

Growers will, however, be concerned not only with the performance of their staffs, as compared with these standards; they will also be concerned with raising that productivity by the most promising methods available. At

* The standards given later are calculated on the basis of 1952-53 conditions and could be refined by using the indices of horticultural prices for subsequent years.

this stage, then, attention must be drawn to the fact that any measure of labour productivity which depends on the relationship between labour cost and the value of the product of that labour measures the total effect of many diverse factors. Clearly, it measures the volume of work performed by the workers. But it also measures the correctness with which the grower has selected his range of crops, their timing for marketing at the most advantageous period, the technical competence with which the crops are produced, the amount of mechanical power available to assist the staff, and the appropriateness of the layout of the holding. Improvements in any of these latter factors will increase the productivity of the staff without the expenditure of any more effort by the staff itself. While the most promising ways of raising labour productivity depend on the possibilities for improvement which lie in the individual business, three ways are regarded as being more generally applicable than others. Each of these ways is now discussed under the headings of work simplification, incentive payments, and the provision of adequate fertilizers and power.

Work Simplification Very considerable possibilities of improving labour productivity are thought to lie in the application of work simplification techniques to horticultural tasks. Work simplification is used to denote what is more familiarly called time-and-motion study, but in this context the terms are not regarded as synonymous. Time-and-motion study, on the one hand, has a rather impersonal flavour, and there are some doubts as to whether the very detailed inquiry into work methods which it connotes is applicable to any but a small proportion of horticultural tasks. Work simplification, on the other hand, aims at giving free rein to the technical skill of the worker by relieving him of part of the function of providing power and by the removal of redundant or unnecessary processes. It is thus capable of wide application. In horticulture the worker has to use some measure of technical skill for a great many tasks, and a great deal of technical skill in performing some others, while at the same time providing with his own muscles the motive power required. No criticism of the individual worker is implied by the application of work simplification techniques—rather is there a criticism of the traditional way in which workers learn how to do the tasks on which they are engaged.

How is work simplification carried out? There are three stages involved in the application of the techniques. The first is observation. In this one has to see what goes on in the performance of any task. The second stage is descriptive, and in this stage some kind of formal record is made of the sequence of jobs, the time taken by each, and so on. The third stage needs the application of some ingenuity in contriving a better way. These three stages of study are applied to the job—such as the transference of tomatoes from plant to basket; or to the process—such as the handling of apples from tree to market lorry; or to the place where jobs and processes are carried out; or to all three.

Lack of space forbids more than a cursory review of the results which have already been obtained in these three fields: a few examples will have to suffice.

The Job. Two-handed picking of tomatoes, as opposed to carrying the basket in one hand and picking with the other, not only speeds up the job so that a basket is filled by the first method is three-quarters of the time taken by the second, but also relieves the picker of the task of carrying the basket continuously. Systematic picking of black currants, as opposed to haphazard picking, increased the quantity of fruit gathered in a given time by 50 per cent.

The Process. It is instructive to take as an example the process of filling a spraying machine tank with water and concentrates by a team of three people. Four distinct jobs are involved: (*a*) filling the tank with water; (*b*) measuring out the concentrates; (*c*) mixing the concentrates; and (*d*) pouring the mixture into the spray tank. In one instance observed the last three jobs took 14½ minutes and the first job 12¾ minutes. By reallocating jobs and cutting out unnecessary travel the last three jobs could be performed in 7 minutes. Of course, any saving below 12¾ minutes would be more apparent than real, for the tank-filling time would then have determined the speed of the process.

No task on a fruit farm needs to be carried out more expeditiously than spraying. It is important to keep the machine working in the orchards for as much of the day as possible, and thus it is essential to keep the time spent in filling (which may be as much as one quarter of the whole) to the minimum. Inquiry into the process noted above directed attention, first, to the organization of mixing and measuring, and, secondly, to the way in which the tank was filled with water, and thus challenged those concerned to find a more speedy way of filling.

The Place of Work and its layout provide many points which encourage labour extravagance. How many glasshouses built over the last few years have, for instance, been provided with wide doors; and in how many of them are the crops so planted that a truck or barrow can be run up the centre paths to obviate carrying everything to the door by hand? Examples of this kind of bad planning could be multiplied many times over.

Incentive Payments Incentive payments cover all those rewards of which the essential feature is that payment is related in some way to the effort expended by the worker or the amount of work he performs. Growers are familiar with this system in paying piece rates, and the piece-work method of payment has been, and still is, used to reward casual employees doing repetitive jobs like hoeing, singling, fruit-picking and similar jobs. Growers are, however, now adopting the piece-work method of paying their regular staff when employed on suitable jobs, the object being to reduce the cost of the job, or at least to put a "ceiling" on the cost, and in this way to ensure a certain standard of labour productivity.

The fixing of piece rates is, nevertheless, something of an empirical process, as every grower who has tried it knows. Recently, attempts have been made (notably by workers at Fernhurst) to clarify and systematize the process and to apply it to a much wider range of jobs than has hitherto been thought possible. So far, the attempts have been successful, and reports of a 28 per cent saving in labour cost, with a 20 per cent increase in output, are too striking to be ignored by the horticultural industry.

Provision of Fertilizers and Power Every grower will agree that the quantity of produce which his staff is capable of producing is governed in some measure by the extent to which two other productive resources are provided—namely, fertilizers and manures of all kinds and power. It is clear, then, that the full potentialities of a worker are only realized if the appropriate levels of soil fertility are present. It is also clear that the more assistance a worker has in the shape of equipment the more work he is likely to perform in a given time and the greater the value of his production is likely to be. No one will dispute these statements, but some doubt may nevertheless be entertained as to whether or not growers are limiting the potentialities of their staffs by inadequate provision of fertilizers and power.

The twenty-seven market-garden holdings taken as an example earlier in this article have been grouped for the present purpose in Table 2 into three groups, according to the level of net output per £100 labour, including unpaid family labour. A comparison is then drawn between the levels of fertilizer application per acre, the levels of power per acre, and the surpluses per acre after rewarding all manual work.

Table 2

Comparison of Labour Productivity with Fertilizer and Power Used on Twenty-seven Market Gardens in 1952-53

Net Output per £100 Labour	Number of Holdings	Cost of Fertilizer per acre	Power Costs per acre	Surplus per acre
£		£	£	£
Over 250	11	16	54	71
200-250	7	10	31	17
Under 200	9	10	22	−17

As might be expected, there is a very close relationship between the surplus and the level of labour productivity. It appears, too, that one of the limiting factors to higher productivity in the lower groups is the lack of sufficient capital equipment to realize the possibilities for work which lie in the staff employed. On the limited material available, the case for the use of more fertilizers is hardly so clear-cut. It would, in fact, be a surprising result, bearing in mind the complex nature of the measure of labour productivity used, if all comparisons were so true to expectation as the relationship which appears to exist between labour productivity and power use. It would appear, however, that those growers who achieve a high level of labour productivity recognize the value to them of adequate use of fertilizers in achieving it. Fertilizer use may, perhaps, not become a limiting factor until a certain level of labour and productivity is reached, but it would be unwise to draw this conclusion on the present evidence. The matter obviously merits further careful study, but meanwhile the individual grower who is dissatisfied with the figures for his own holding, as measured by the yardstick given earlier, can look to a possible increase in labour productivity by providing more power, and perhaps also by the more liberal use of fertilizers of the right kind at the right time.

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ENGINEERING DEVELOPMENTS IN THE GLASSHOUSE INDUSTRY

G. P. SHIPWAY, M.Sc., B.Sc.

N.A.A.S. Liaison Unit, National Institute of Agricultural Engineering, Silsoe, Beds

New ideas and equipment in glasshouses directed to increasing efficiency have done much to counteract the rising costs of production. Some of the more recent developments in heating, lighting and sterilization are here surveyed by Mr. Shipway.

THE recent trend of increasing costs of production has led to a demand for higher efficiencies in all branches of the horticultural industry. This demand has not yet been fully satisfied, but great strides have been made by the introduction of new equipment and methods, some of them resulting from work carried out by the National Institute of Agricultural Engineering and other research organizations. In addition to this fundamental work, efficiency has also been increased by the introduction of equipment previously confined to other industries. This is particularly true in the field of glasshouse heating, and although it cannot be claimed that these are fundamental developments, they are just as important in providing better growing conditions at lower cost.

New methods of heating glasshouses have had three main objects: to give better control of growing conditions; to use the fuel available more efficiently; and to reduce labour costs. To achieve the first of these, it must be the aim to maintain the house temperature at the optimum level at *all* times and in *all* parts of the structure. On the next point, it should be borne in mind that fuel is the second largest factor in the cost of production in heated glass. During the last few years there has been a steady rise in the price of solid fuels, and even today there is no guarantee that the price will not continue to go higher. It is thus imperative for each grower to save fuel, not only in his own interests, but in those of the industry as a whole and of the nation. As regards labour, it is difficult on the smaller nurseries to assess the amount of time spent in firing, ash removal, and adjustment of house temperature, but where it is necessary to pay a night stoker the costliness of the operations becomes only too clear.

Efficient and Economic Heating Let us look first, then, at some of the advances in the field of controlled heating. The old gravity system with 4-inch diameter cast-iron pipes and a hand-fired boiler, although cheap to install and independent of external power, does not provide a constant house temperature. There is generally a variation in temperature throughout the house, and almost invariably fluctuations during the night. Such uneven temperatures are wasteful of fuel and give poor growing conditions. The distribution of heat in many gravity systems has, however, been improved markedly by fitting into the main an electrically-driven circulator pump. The pump can be of such a type that, should it stop, natural gravity circulation will not be impaired. The introduction of this circulator enables both the boiler and the pipes to be situated at ground level. This season many nurserymen have improved their heating systems either by raising the boiler out of a stoke-hole, where flooding was common, or by lowering the flow-pipes from eaves to ground level. The latter arrangement results in more efficient and uniform heating.

Total reliance on a pump for circulation has the disadvantage that circulation ceases if the pump stops, and a hand-fired boiler will then overheat. Breakdowns are rare, but when such a system is installed it is best to have a warning device to indicate lack of circulation.

The present trend is to have one or two efficient boilers situated in a central boiler-house, replacing many times that number of small boilers. This is the result of the adoption of automatic firing and other control equipment, the cost of which is not in direct proportion to size. Thus for double the output, the capital cost of a firing unit would only be about 20 per cent more. A wide variety of automatic firing equipment is available. In all cases a thermostat controls the fan supplying the air for combustion and, in most instances, the fuel feed mechanism as well: in this way, heat is supplied when it is required. Automatic firing is more efficient than normal hand-firing, and its introduction, together with the automatic control of house temperature by thermostats, results in a big reduction in fuel costs. Labour costs are reduced, too—the amount of saving depending upon the type of fuel and equipment. Oil is also being used in place of solid fuels on an increasing number of nurseries, especially in the south of England. Although at the moment this is generally a more expensive form of heat than solid fuel fired automatically, the saving in labour costs can make it an attractive proposition on some holdings.

Low-pressure Steam and High-speed Water Heating Even with the best control equipment, it is not possible to obtain an even temperature in the houses with 4-inch diameter heating pipes, because of the large thermal inertia of the system. Better distribution and control of temperature in the houses are obtained when small diameter heating pipes are introduced. These are normally between 1¼ and 2 inches in diameter, but other sizes can be used, provided they will fit in with the method of growing and give the required house temperature. Both steam and hot water can be used as the heating medium in small pipes.

Low-pressure steam systems normally work at about 5 lb. per square inch, giving a pipe temperature of 227°F. This system, using the same centralized boiler for heating and soil sterilization, economizes in capital outlay. Each house can be treated as a unit having its own control of temperature. This is an advantage where many different crops are grown and where a rotation is practised. The design of steam systems is not simple. There is always a tendency for variation of temperature along the length of the house, and in some circumstances this can be serious if proper precautions are not taken.

Many high-speed hot-water systems are being installed at present. The water, normally at about 175°F., is circulated in small diameter pipes at such a rate that the drop in temperature of the water as it travels round the system is not greater than 20°F. With a good pipe layout, an even temperature distribution can be obtained in the houses. There is a quarter as much water in the 1¼-inch diameter heating pipes as in an equivalent 4-inch pipe layout, thus reducing the thermal inertia of the system and making it possible to obtain better temperature control. On some nurseries these small heating pipes have been connected to the mains with a length of rubber hose at each end. This method of fixing has many advantages. The pipes can easily be disconnected and moved to the side of the house during cultivations and soil sterilization. Again, the distance between the pipes can be altered to fit in with successive crops without any additional

pipe work, and during the pre-planting period the pipes can be laid on the soil, thus greatly reducing the time taken to warm it. In a heated mobile house the pipes can be raised without disconnecting them to clear the crops when the house is moved.

Where new hot-water heating systems are being installed, many growers are choosing a boiler which can be used to produce both hot water for heating and low-pressure steam for sterilization. Steam and hot water are not obtained at the same time.

Various types of air heaters, in which the air is either heated directly from a furnace in the house or from a steam coil, have been used on a limited scale in glasshouses. In most cases, air circulation is maintained by a fan. High thermal efficiencies are often obtained from those units in which the furnace is in the glasshouse, but so far no unit has been found which will give an even temperature distribution throughout a large house.

Soil Warming, Artificial Lighting and Sterilization Although some growers have been successful with soil warming, opinions differ as to its value and the soil temperature required. Heat can be provided in the soil either by a grid of electrically-heated wires or by a series of small diameter hot-water pipes connected to the heating system. Effective warming of the soil can be achieved, where small diameter pipes are used for heating, by laying the pipes on the soil surface during the pre-planting period. When warming is complete the pipes are raised off the ground and placed on their normal supports, which need be no more than bricks or blocks of wood. With this method it is possible to warm the soil thoroughly within 48 hours of turning the heat on. The system is particularly attractive, as no additional capital equipment is required and soil warming is obtained at the only period when it is really necessary.

From December to February the intensity of natural light is insufficient for vigorous and healthy growth. An attempt has been made to overcome this by the use of supplementary artificial light supplied by high-pressure mercury vapour lamps, which give high light intensity without a great increase in temperature. These lamps are being used mainly on tomatoes and cucumbers. It is essential that the tomatoes should receive 6 hours of darkness in every 24 hours, and that the temperature near the plants should be carefully controlled.

It is claimed that supplementary light with tomatoes results in higher yields, earlier fruiting, and heavier fruiting during the early period. There are two methods of using artificial light: to propagate later than normal and market at the usual time, thereby reducing the period of heating; or to propagate at the normal time and market earlier when prices are higher. A wide variety of factors influence the grower in deciding whether to use one of these methods or a combination of the two.

It has been generally accepted for many years that steam sterilization is the most efficient way of killing soil-borne pests and diseases. Until recently, a high-pressure steam boiler was considered to be necessary for steam production, and this, because of its construction, was costly. Many small nurseries could not justify this capital expenditure and either relied on the services of a contractor or used alternative methods of sterilization.

Steam is the medium by which heat is transferred from the boiler to the soil, and only when saturated steam condenses does it give up its heat. Soil can only condense steam at a given rate, which varies for different soils.

In the past, the area steamed at any time was often too small for the steam output of the boiler. High efficiencies are now being obtained by increasing the area of injection equipment so that each square foot of soil surface receives steam at the rate of not more than 20 lb. per hour. Large savings of fuel have also resulted from the introduction of a pressure-reducing valve in high pressure systems. This maintains the flow of steam into the soil at the optimum rate, irrespective of the position of the area being steamed in relation to the boiler.

Recent work has shown that a high-pressure boiler is not essential for sterilization; indeed, with badly-designed ancillary equipment it can result in a large wastage of steam, and hence of fuel. It has been found that boilers producing steam at 5 lb. per square inch can be used successfully, provided the rest of the equipment is of the correct size. It is thus possible to use a wide variety of steam boilers for the job, ranging from specially-designed, low-pressure steam boilers to certain types of hot-water boilers which are capable of producing steam.

Trickle Irrigation The introduction of a watering system whereby each plant receives a uniformly measured quantity of water and nutrients from a permanently laid pipe, has put the control of watering and feeding of glasshouse and border crops into the hands of one man. Thus the grower has complete, immediate and direct control over the growing crops. The amount of labour is reduced, but this saving has to be set against the cost of the equipment and its depreciation. If the treatment is right, good results will be obtained; if, on the other hand, it is wrong, all the plants will suffer, with a resultant effect on yield. Watering by trickle irrigation is a skilled job, and there is no room for mistakes. It is necessary to watch over the plants continually: any change in the appearance of the crop has to be noted quickly and adjustment made accordingly. Good results are not always obtained on open sandy soils, because of the quick drainage and little spread of the moisture, and further work is required on the method of applying trickle irrigation to these soils.

Glasshouse Design The design of a glasshouse should be such that the plants receive the maximum amount of light and heat from the sun and are yet protected from cold winds. Until 1939, houses were usually constructed of soft wood which, because of its lack of strength, necessitated large members closely spaced. But the members can be of a smaller section and be spaced farther apart if materials of greater strength are used in place of soft woods. Two such materials which have found favour with the industry in recent years are imported hardwoods and aluminium. The mobile glasshouse is an attempt to reduce handling costs and to spread the capital expenditure over as many crops as possible.

Considerable developments have taken place during the last few years in glasshouse equipment and design, and they can, if properly applied, help the horticultural industry to market better produce with lower costs of production. But although so much has been achieved, a great deal more research and development work in all branches remains to be carried out before the industry can lay claims to full efficiency in production.

Correction

December 1954 issue, p. 416. In the table giving the spraying agents used, the description of the tar distillate winter wash should read "9 per cent cresol and phenol as the active agents".

PROBLEM OF THE SMALL UPLAND DAIRY FARM

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It is no easy job to make a reasonable living out of some of the small upland farms lying near the industrial towns of the West Riding of Yorkshire and Lancashire. The writer, who knows this district well, discusses the ways and means by which the circumstances of these holdings might be improved.

IN upland areas of the British Isles many small farms are to be found on land which, by its very nature, is of low potential productivity. Here altitude, climate, soil and accessibility are limiting factors in the choice of husbandry. In true hill districts most holdings have both in-bye-land and fell or moor rights, and are thereby able to maintain a flock of hardy breeding ewes. Though war-time needs and limitations tempted many of these farmers into liquid milk production (the cost of collecting which far outweighed its monetary value to the State), the true enterprise allied to the sheep flock is that of rearing cattle for the lowland areas. Cattle which go down to the lowlands when approaching their productive phase almost invariably do much better than if kept on the hills for finishing or milk production. It follows, therefore, that by remaining in milk production the true hill farmer is reducing the total potential gallonage of milk in proportion to the number of milk animals he keeps. Few such farmers would claim that to finish bullocks on the hills is an economic proposition, and yet they are prepared to retain milk beasts which, though capable of, say, 800 gallons on lowland farms, will probably give them less than 600 gallons under their own conditions.

This article is not, however, concerned with the true hill farm but with what, for want of a better term, can be described as the "betwixt and betweens". There are, in many parts of the country, holdings which can be classed neither as true hill farms nor as lowland units. These have upland conditions but no common grazings or gated land, and since many of them are situated close to urban centres, sheep are doubly precluded. The urban influence does, however, provide a doorstep market for liquid milk, eggs and vegetables, and has thus given rise to a type of husbandry almost entirely composed of dairying and small livestock. One such area lies in the neighbourhood of Huddersfield, Halifax and Bradford in the West Riding of Yorkshire and in the adjacent areas of Lancashire.

Background to the Problem Before considering the present-day position in this area, it is necessary to reflect for a moment on the conditions prevailing in the period immediately before the last war. The average size of these holdings is around 20 acres, and they were at that time almost entirely grassland of the *agrostis* type. The buildings are in the main more than adequate for the acreage of land farmed and, though built many years ago, provide tying up for more cattle than could possibly be supported by the land attached. Feedingstuffs were both plentiful and cheap in the late 1930s, and these farmers, being mostly producer-retailers, were able to obtain a lot of milk on a small farm economically by keeping their mistals fully occupied, feeding cheap, purchased feedingstuffs along with their own hay, and using their pasture land as exercising ground. In the same period, employment in the neighbouring mills and factories was not at its peak and thus casual labour for busy times was not difficult to find.

War conditions changed all this and caused a general reorganization of both ideas and enterprise. Pig and poultry populations shrank to a fraction of pre-war numbers and only the dairy side of the business remained fully productive. It now became necessary to provide more and more food for stock from the sparse acreage available—mainly by reseeding, and partly by ploughing some of the grass out for arable production. All this is now history, and it would perhaps be better to draw a discreet veil over the trials, achievements, disappointments and mistakes of those days which, though very real at the time, have been succeeded today by still greater problems.

For eight years feedingstuffs remained rationed and all farmers had, therefore, to rely more and more on their own resources. On many farms this proved a blessing in disguise and showed that a lot of unnecessary money had been spent on stock food before the war. The operative word in this connection is, however, *resources*. On these small farms. the resources are obviously very limited. Much of the land is steep, defying the skill and daring of man to plough it. The very soil itself is of that moderate acid material derived from Millstone Grit or Coal Measures. Nature, knowing full well its limitations and lack of fertility, has clothed it with a sward which is happy under such conditions, but one which is not very productive by present-day standards. And moreover, fumes from the nearby mills quickly negate applications of lime and make it essential to lime the land frequently. There are drainage problems even in this close-contoured district. A high rainfall makes cereal cropping hazardous, though less of a gamble on the sunny side of the valley than on the northern slopes, which get only very little sunshine in a year.

Rents, as is peculiar to small farms, are high in comparison with more productive holdings in more favourable areas. They are often as high for one acre as for three of the latter. The buildings, though excessive for the acreage, in many cases do not conform to modern requirements for milk production. Many of the farms are situated in remote parts at the end of a long, rough, tortuous road only assailed by the strong-hearted and those of sound physique. Modern amenities have reached the half-way-up holdings, but not those at the top.

A Question of Economics The real problem is, however, one of economics. During the war and part of the time since, it was possible to obtain a reasonable return for expenditure of cash and energy. Liming, made possible by the 50 per cent grant, improved the more accessible grassland and made the better arable areas much more productive than they would otherwise have been. The availability of Committee machinery enabled the more go-ahead men to have a portion of arable land on their holdings and made it reasonably possible to harvest the resultant crops. A considerable area of grassland was ploughed out and reseeded direct under contract, and this work is still going on as part of the Marginal Production Scheme, for which a great deal of the area qualifies. Most of the holdings are dairy farms, and so do not come within the terms of the Livestock Rearing Act.

These facilities are still available, and there has been added to them the £10 and £5 per acre grants for ploughing up grassland: but there are limiting factors. A fair amount of the soil, on analysis, shows a lime requirement of 6 tons ground limestone per acre. It is not the actual cost of the material which matters, but the additional cost of getting it on to the land. The difference between applying 3 tons and 6 tons is immaterial on normal

terrain, but when it has to be carted up steep, narrow lanes, where manoeuvring through field gates is tricky, and applied to small fields of under 2 acres, where a track-laying vehicle is the only one likely to be suitable, then it is quite a different matter. And lime is only the beginning, for it must be followed by phosphate, potash and nitrogen.

What of direct reseeding? Much has been accomplished, but much remains to be done. Those areas dealt with must constantly be followed up otherwise they quickly revert to moor. On many holdings, by the time the last fields have been reseeded the first are ready to come out again. The cost of this work has increased each year and the money to pay for it takes some finding. Committee machinery now has to break even financially, and the per acre cost of putting a new face on a high pasture amounts to as much as its capital value. It would be safer to say its so-called "capital" value, for heaven forbid that anyone should try to assess the worth of farmland in this country today. But the tenant farmer often views these costs as expenditure per acre without also estimating the potential return in terms of gallons of milk per acre for the duration of the ley.

It is not conducive to good farming to have to rely on all mechanical operations being done by contractors, however good, whether private or Committee. On the other hand, if these services cease to be available this work will virtually come to a stop on most of the farms in these areas. Twenty acres or so cannot support a tractor and following machinery on a farm of this nature. They cannot really afford a horse-drawn reaper, hay-rake and sweep. The only mechanization on such holdings which will not result in over-capitalization is a milking machine and some barn machinery. What is to be done then? These holdings must either be over-capitalized or rely on contractors. They are not able to enjoy the advantages of modern equipment, as do the bigger farms. They must either farm the dear way or remain old-fashioned by resorting to the hand methods of last century, which in turn are also costly.

Struggle for Existence It is no good being critical if one does not try to be constructive. In this case, that is the most difficult part. The most obvious solution is to amalgamate several of these holdings to form an economic unit. On paper this sounds fairly simple, but in practice it is full of snags. Holdings in these areas sell at between £1,000 and £1,500, so that to make 100-acre units the initial capital outlay would be £5,000-£7,500—a not inconsiderable beginning, bearing in mind the cost of equipping a holding of this size at today's prices. On the other side of the fence, the existing landowner, even if he were willing, would have the utmost difficulty in persuading four tenants to vacate their holdings so that they could all be attached to a fifth. No, whoever started such a scheme would be like the woodman who plants a hardwood forest and does not live to see the fruits of his labours!

In normal times this type of farmer has a constant struggle for existence, so that a year like 1954, which shook many men much more favourably placed, came as an acid test. Haymaking, always a hazardous business in the hills, became almost impossible under last year's weather conditions. Hundreds of acres were abandoned in the field, a large acreage was not even cut, and the hay which was carted was so badly weathered as to be of little use other than for bedding. Even though grazing was more plentiful and possible later than usual into the autumn, the upland farmers started the winter in a very precarious position from the fodder angle. Some of them belatedly attempted silage-making, but since the herbage which they ensiled

had in most cases deteriorated beyond redemption, their efforts were foredoomed to failure from the start. The pity of it is that the results they have had from this type of silage will probably prejudice and deter them from trying to make good silage this year.

What are the consequences of all this? We have a free market, and under such conditions the old law of supply and demand holds sway. Hay prices have soared, as was inevitable; mangolds—a disappointing crop in the lowlands—are not as easy to buy as in other years. Straw (that is, good straw) would have helped the situation considerably, but there is none to be had. Much of it is still in the fields, as indeed are some of the oat crops which these farmers tried to grow. What oats they were able to salvage made very poor feed. In all, a very black outlook for our upland farmers, calling for a lot of improvisation and causing many heartaches. The probable outcome is a drop in milk yields and stock in very poor condition at turning-out time.

Full Exploitation of the Holding For those who survive, the only solution, as I see it, is full exploitation of the holding itself. This, on many of them, would mean a much greater appreciation of the potential production from grassland—the natural product of these areas. It would mean learning to look on grass as a crop, making the fullest use of lime and fertilizers (especially nitrogen) and, above all, the proper utilization and conservation of herbage. Was there ever more obvious scope for intensive grassland farming than in areas such as these? The small fields provide ready-made units for controlled and rotational grazing. A silage pit could be sited almost anywhere on the farms, since banks with adequate run-off for the effluent exist in most fields. Even the normal rainfall is an ally on the side of herbage production and the effective use of nitrogenous fertilizers. If the soil is fed, nature will respond by changing the sward in reverse from the poor types to the better species capable of enjoying better conditions, which in turn will lead to higher production.

The increase in production from grassland and consequent output of milk which is being achieved on a small number of holdings of this type by men who are grass-minded and have discovered the advantages of generous fertilizer treatment coupled with good grazing technique, is prodigious. I think most of the answer is there every time they look out of the window or put foot to the ground.

If milk production is to remain the primary enterprise on these farms—as with a ready-at-hand market it probably will—then it should have allied to it secondary enterprises which can build it into an economic whole. The enterprises should be so blended that they collectively make full use of the holding's resources in capital, labour, soil and equipment. This is important, because a farmer who has several sides to his farming may think that one particular branch is paying handsomely, whereas on analysis he may find that it is doing so only at the expense of another side of his activities.

It all boils down to a question of management. The occupier of a holding of this size and nature cannot afford to waste one square yard, any more than he can hope to succeed by haphazard methods. The first essential. then, is for every occupier of such a farm to take stock of himself. This will entail an honest assessment of his policy and methods based on the resultant returns in terms of production per acre and per man-hour. It is a fact that the cost of producing a gallon of milk shows enormous disparity between farms of a similar nature in a given area.

The place to start is with a scrutiny of his grassland. This is his raw material, his producing medium, the quantity and quality of which determine the amount of milk which he can produce economically. The more of this which he produces and the higher its feeding value, the lower will be his feeding bills, and therefore the lower the cost of his milk. He must ask himself whether the right species are in his swards—the productive, palatable, persistent types. Are they swards which with good management will give him grazing over as long a period of the year as possible, or a good bulk of nutritive herbage for hay or silage? Is he satisfied that his fertilizer treatment is generous enough to allow them to give of their best? He must find out why the man on the next farm can always turn out to a good bite a fortnight before he can. If he is satisfied that he is using all the fertilizer necessary, he should nevertheless try one field with a little extra this year just to make quite sure.

He may have reached this point in his self-examination with satisfactory marks, and if so his next step is to examine his utilization methods. Having produced the goods, how successfully does he turn them into the end product —milk. First of all, let him look to his pasture land. Does he turn his cattle into a field and let them eat and waste what they want, or does he give them what they can eat that day and keep the rest clean for another day by using an electric fence? Perhaps he throws all his field gates open and gives the cows *carte blanche*. That fellow down the lane strip-grazes his grass and it seems a job to have to move the wire each day: but come to think of it, his cows spend longer in a field than other people's. And what of provision for winter? Good hay. That's the stuff; there's nothing like it for milk. A pity, though, that it always seems to rain the minute haymaking starts. You can generally get some good hay but seldom all. Silage; that's the answer. Instead of trying to make all his meadows into hay, he'll put some of it into a silage pit. And if he has a pit he can always cut some of the pastures which have got away from the cows in a lush time and ensile it for the winter. It's very handy to have an alternative way of conserving grass.

His other activities should come under similar scrutiny and all be measured by the yardstick of profitability. Winter feeding methods, use of buildings, degree of employment of his own labour and any other he may have.

Increased Productivity need not be Costly Where is the money to come from to make it possible to have such a farm fully productive? That is an obvious reaction and one frequently met. "It is all right on paper, but these men just haven't got the capital to put it into effect," one is often told. A well-known Northern Friesian breeder was once asked in the earlier stages of his career where he got the money to buy all his high-priced Friesian stock. "From Friesians", was his answer.

Much of the money needed for full exploitation of these small farms can come from good management, which doesn't cost anything other than mental energy. Improved management can save a considerable amount of waste which, in the long run, means cash. Better production and conservation from grassland will save high-priced feedingstuffs by cutting their use down to what is required by the highest producers. Feeding the precious winter food according to yield and not *ad lib.* can save sufficient for another cow or two without any reduction in output from the present herd. Controlled grazing will result in grassland carrying more stock on the same acreage.

Culling the passengers, whether cows, hens, pigs or workers, will save money without reducing the economic output by increasing the herd or flock average. It's not numbers per acre which count, but output per acre. What advantage is there in being able to say you keep 10 cows and 300 head of poultry if your average milk yield is only 1½ gallons per day and your flock average 100 eggs per year? Far better to be able to say your milk yield averages 3 gallons per cow per day and your flock average is 180 eggs per year.

On a small farm where labour is limited, it is essential that all the jobs should be done with the least possible expenditure of energy and time. A doorway knocked into a wall to save a detour can make a lot of difference, especially in wet weather. Similarly, poultry kept in small units on various parts of the farm require far more attention than if they are all in a straw-yard and can be attended to in one operation. The time saved can be put to another use; one man or woman can look after a bigger flock in less time. The obvious enterprises to be allied to dairying on the farms under review are pig- and poultry-keeping, so that the more compact the unit the less the labour expended.

Adequate feeding space and proper feeding utensils will result in more even production and less waste of food. The money so saved can be spent on more fertilizers to produce more from the land. This improvement of grassland may have to be a gradual process, but provided a good foundation is laid when each field is tackled and adequate follow-up treatment is given, the final result will be most satisfying.

"The farmer's foot is the best manure." Whoever originally thought of that certainly hit the nail on the head. And yet many of these upland dairy farmers and other urban dairy farmers retail their own milk. This generally takes all the morning and, in some cases, part of the afternoon. On returning from the round there is washing up to do, and by the time that is finished it is milking time. What about the land? I suggest that it would be far better to sell the milk to dairies and let them do the delivery. The difference between retail and wholesale price could be more than compensated by the amount of time which would then be available to spend on the holding. It would probably mean that the size of the pig and poultry units could be increased.

What is the alternative? At present many of these men are not earning a farm worker's wage. They have responsibility, worry and risk, and would probably be as well, if not better, off working for someone else. Or has the fact of being one's own boss and farming one's own land a value which, added to the worker's wage, makes it all worth while? I do not know, but I do know that today more and more of these men are drifting into part-time or full-time jobs in local industries and, as a result, their holdings are not fully productive, which means in the aggregate a big loss to our food supplies and a brake on our production drive as a whole.

Drive against Wood-pigeons

The campaign against wood-pigeons is to be intensified by organized shoots. Interested landowners and farmers should get in touch with their County A.E.C. who have arrangements in hand for the appointment of reliable organizers. Cartridges can be obtained from the C.A.E.C. at half-price.

IMPROVEMENT OF A SOMERSET ESTATE BY LEY FARMING

GEORGE JARRETT

Clevedon, Somerset

For twenty years Capt. Wills has been taking the plough round the poor hill land of his Somerset estate at Barley Wood, Wrington. The measure of the improvement he has brought about can be judged from the following account of his successes in both the arable and livestock fields.

ON his North Somerset estate Capt. Douglas M. Wills can boast over thirty years of personal farming, of which twenty have been based on a policy of leys and the ploughing and direct reseeding of poor hill land. Land valued at 12*s.* 6*d.* per acre during the First World War has recently been growing up to 20 sacks per acre of oats—eloquent testimony to the soundness of the farming system being practised. Barley Wood is a well-known address in Somerset, for Capt. Wills was the Chairman of the County War Agricultural Executive Committee from 1940 till 1948 and during that time the county's carpet of permanent grass was converted into a farming pattern bearing a close resemblance to a patchwork quilt.

Looking back, it is possible not only to study the effects of a continuous policy of land improvement, but also the period of intensive cropping during the war, when many of the respected tenets of good husbandry had perforce to be cast aside. During this period, too, there have been changes in the stocking policy from beef to dairying, and now back again to beef, with the formation of a herd of Devon cattle; from days when quantity was the great consideration to those in which quality and profitability are once again taking precedence.

When Capt. Wills started farming on his own account in 1925 he had 120 acres, but this has now been increased to the present total of 291 acres, representing about half the total area of the Wrington Estate. At Abbotsleigh, on the outskirts of Bristol, there are another 1,700 acres, including 600 acres of woodlands let to the Forestry Commission on a long lease. Much of the farmland on this part of the estate is in the hands of good farmers who also use the plough and the ley as the basis of their mixed farming operations.

The Plough is Introduced The farming unit at Barley Wood now comprises two farms—Barley's Farm and Meeting House Farm. Originally, there were only very small proportions of arable, but they were increased greatly during the war. Some figures which Capt. Wills has supplied show the tremendous change that took place. Before 1939, the total arable acreage was less than 30, including one-year leys. During the war, the tillage area rose to 125 acres, and every grass field on the farms which it was possible to plough came under cultivation. Alternate husbandry has been practised ever since the ploughing programme started, and is being continued, although the proportion of land under three-year leys (or longer if necessary) will be increased in the future. Although not ideal wheat land, the acreage under this cereal rose to 50 in one year, and as many as 14 sacks per acre of Atle have been grown on newly-ploughed grassland. The acreage under corn must, of course, vary according to post-war economics, but there has been no hurry to reduce it. The Barley Wood

farms will continue to be farmed with the plough and the ley as the basis of fertility.

It is interesting to delve a little into the earliest days of ley farming and grassland improvement on this estate, and into the reasons which prompted their introduction. It was in 1934 that ploughing-up and reseeding first took place on the farms, largely at the instigation of Mr. W. D. Hay, then Principal of the Somerset Farm Institute at Cannington.

A start was made with the ploughing and direct reseeding of about 7 acres of the highest land on the farm, lying at about 500 feet, and with very shallow soil close to the rock. This land was ploughed, limed, manured and thoroughly worked, until it was reseeded with a mixture consisting of:

	lb. per acre
Italian ryegrass	4
Perennial ryegrass	12
Cocksfoot	8
Timothy	4
Rough-stalked meadow grass	1
Broad red clover	2
Late-flowering red clover	3
Wild white clover	1
	35

Today, as a result of the great strides which have taken place in the study of grassland and the production of improved grasses and clovers, Aberystwyth strains are included in the mixtures. The earlier heavy seed rates have been reduced, without any loss in the quality of the sward.

Good Cultivations and Heavy Fertilizer Programme There can be little doubt that the ultimate success of ploughing and reseeding in Somerset was largely due to the doctrine of doing the cultivations really well. On the matter of fertilizer policy, the practice at Barley Wood has been to use plenty of basic slag, particularly to the phosphate-loving leys, where up to 10 cwt. per acre have been applied. Heavy dressings have been given when the leys are seeded, so that they get away to a good start, and a further application of half the initial quantity is made about three years later. Capt. Wills recalls one occasion when part of a reseeded field was accidentally left unslagged. Here the ley was a complete failure. This seems to prove how important it is to ensure that the young leys have plenty of phosphates and that really good grass cannot be grown without them. Even today, too many farmers attempt to economize in the use of fertilizers for young leys, with the result that reseeding never produces the results anticipated.

One field on the estate, known as West Park, had not been ploughed for fifty years. On being broken up, it grew two crops of Holdfast wheat and one of dredge corn before being reseeded to a timothy-meadow fescue ley without a cover crop. It has since produced a tremendous amount of grass: indeed, so productive has it proved that it has been necessary to strip-graze it.

In common with other farmers, Capt. Wills has found that his cattle occasionally tend to forsake the generous growth of succulent leys in favour of something from the hedgerows. He therefore believes that, despite the indisputable merits of ley farming for high production, it is still an advantage to have some old permanent grassland to provide variation in the diet.

Some trouble has been experienced with bloat, mostly with young stock, so the broad red clover and late-flowering red clover have been omitted from the seed mixtures in an attempt to avoid it.

Several soil formations are to be found on the estate, and this naturally adds to the complexities of farming. On the hills the soil is very thin and close to the underlying rock, so that it burns badly in times of drought. Most of the land can be said to consist of medium loam, with variations of red medium loam, brashy, red-brown silty loam, and brown light loam. The rocks vary from Carboniferous Limestone to dolomitic conglomerate. There is a belt of heavier land below the Redhill-Wrington road, which intersects the estate.

Making Use of Increased Productivity Land improvement of itself is a noble and satisfying aim in life, but it is economically useless to increase productivity unless it can be converted into saleable crops or livestock. Lush leys on what was formerly poor hill land make a very fine sight, but unless they can be translated into meat or milk, or both, they are valueless. Let us see, therefore, how Capt. Wills has cashed the increased productivity resulting from the policy of ley farming. I have already shown how the leys have contributed to increased yields of corn. On the livestock side, both beef and milk have been integrated into the scheme of things, and since the grassland improvement programme started it has been possible to fatten some steers off the leys in summer. Sheep, too, make their contribution to soil fertility and cash returns, and from the earliest days Meeting House Farm has carried a flock of up to 80 Ryeland ewes. Rams and ewes from this flock have been successful at many of the national shows.

During the past thirty years, herds of three different breeds of cattle have been kept on the estate. Pedigree Dairy Shorthorns were first kept on Barley's Farm, and a herd average of 1,000 gallons was built up. But owing to the small amount of accommodation there, combined with the difficulties of getting satisfactory labour for the maintenance of a high standard of herd management on an isolated farm, this herd has recently been dispersed. For twenty years, until their sale in 1950, a herd of Galloway cattle was also kept.

In the future, a commercial beef herd of Devons will be kept on the estate. Capt. Wills's choice of Devon cattle for his new herd has been the result of careful consideration and observation, and can be attributed largely to his travels in West Somerset while Chairman of the War Agricultural Committee. For during the course of these visits he was able to see more of the best Devon herds, both pedigree and commercial, and he formed the opinion then that they really suited the farmer who did not wish to, or could not, go in for milk production. It will be obvious, therefore, that Devons have been selected entirely on practical grounds, and no doubt the characteristics which have made the breed so popular in many parts of the world will prove themselves again on this North Somerset estate.

A start with the new beef herd was made in October 1952, when 19 Devon heifers and a bull were bought. A further thirty were added recently. The bull purchased was Mr. H. C. Howe's " Criddle's Volunteer of Monksilver ".

Throughout his farming years Capt. Wills has been successful not only in improving his poor hill land and growing heavy crops, but also in producing livestock which have proved their worth in the show-rings of many national and local shows, as well as in the commercial field of milk yields and grading centre returns.

Future Policy What will be the future farming policy at Barley Wood? It is intended first to winter more bullocks in yards. These will be fed a store ration and will go off fat the following summer. Some manure will be made this way, and this will be used for the root acreage. Beef and mutton, rather than milk, will comprise the principal sales; the tillage acreage will be reduced from its war-time level, not only because of the changing emphasis in agricultural production, but because such intensive cropping on this hill land just cannot be carried on indefinitely and many of the fields now require a rest. This they will get from a long-term ley which, with judicious manuring and subsequent heavy stocking, will ensure that fertility is built up against any future contingency. The plough, the ley and adequate phosphates will continue to ensure the maintenance of soil fertility and the output at a high level of good quality beef from the fields of Barley Wood.

FEEDING THIS WINTER

The consequences of last year's dire harvest are now being felt, particularly in upland and high rainfall areas. Concentrates and hay are having to be bought in to meet stock needs; but they are costly and should therefore be rationed with the utmost care. First the quantities of the various foods available on the farm must be estimated. Hay in barns or stacks varies from 10 to 15 cubic yards to the ton, depending on density. Loose straw varies from 20 to 30 cubic yards to the ton. Silage can be estimated by taking the figure of 2 cubic yards to the ton. Clamped roots, say, 34 lb. per cubic foot. Cereal grains in bulk storage—1 cwt. per 2¼ cubic feet for barley, 3 cubic feet for mixed oats and barley, and 3½ cubic feet for oats.

The next step is to calculate the weight of each kind of food available per beast over two years old. Cattle 1-2 years old will need about three-quarters, and calves of 6-12 months about one-half, of the bulky food needed for one mature beast. Thus, the daily allowance can be calculated and the supply spread over the winter. A fairly accurate indication of the quantity fed is obtained by occasional weighing of trusses or bales of hay, barrowfuls of roots or silage. Grazed crops should be rationed by the electric fence. Cake, meals and grain should be fed by weight most carefully.

Calves and high yielding dairy cows should get the best quality hay: calves as much as they will eat, plus 3-4 lb. rearing nuts daily. Where the hay is very poor, some of the deficiency can be made up by feeding about 4 lb. of a cereal mixture or dried sugar beet pulp per 20 lb. of hay: with moderate hay, feed about 2 lb. of a cereal mixture per 20 lb. of hay. Oat straw or barley straw can make up the bulk, especially in maintenance rations of stores and low yielding cows. A daily maintenance ration for a low yielder could be 10 lb. poor hay, 10 lb. oat straw, plus about 4 lb. of a cereal mixture. Alternatively, if kale or silage is available, a maintenance ration could be 5 lb. poor hay, 8 lb. oat straw, 30 lb. kale or medium quality silage and 2 lb. cereal mixture or dried sugar beet pulp. In-calf cows and heifers should receive a minimum of 4 lb. balanced concentrates in addition to the maintenance ration for about a month before calving. Store cattle can be wintered on the poorer hay, oat straw or barley straw, together with some green crop, silage or roots according to need.

Weathered hay and straw are low in minerals and vitamins. In view of this, suitable mineral mixtures and vitamin A and D supplements should be added to concentrates fed in conjunction with low quality fodder.

THE AGRICULTURE OF THE NETHERLANDS

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Intensive output, with the emphasis on low costs of production, has given the Netherlands a buoyant agricultural industry, capable not only of feeding its own large population but also of providing a valuable export surplus.

BY contrast with Danish agriculture, described last month, agriculture in the Netherlands is characterized by great diversity. There are wide differences in the type of soil from one district to another, and this leads to variations in farming practice. The country is densely populated, so that the available land is farmed intensively and is able to produce not only food for home consumption but also a surplus for export.

The area of land under crops and grass is about 6 million acres; in 1952, about 56 per cent was permanent grassland, 40 per cent was under arable crops, and 4 per cent was used for horticulture. This national distribution of cropping is not found in any one district, and there are great differences between one province and another. In the province of Groningen, for example, 68 per cent of the land is arable and 30 per cent grass, whilst in the neighbouring province of Friesland the proportion is 13 per cent arable and 86 per cent grass. Horticulture is concentrated in the west and south-west of the country, where about 10 per cent of the land is devoted to it. In one parish of the province of North Holland, the proportion of land under horticultural crops is as much as 40 per cent.

The population of Holland in 1953 was 10.4 million, and some 20 per cent of the working population were engaged in agriculture and horticulture. The high number of people on a limited area of land means a preponderance of small farms. Of the 215,000 holdings above 1 hectare (2.5 acres), some 43 per cent are less than 5 hectares and there are only 200 farms of more than 50 hectares (125 acres) in size. There are also some 124,000 occupiers of holdings of less than 1 hectare.

But, despite the intensity of agriculture, it would be impossible for the Netherlands to feed its population without imports of additional agricultural products. These consist almost entirely of bread grains and animal feedingstuffs. The bread grains are used for direct consumption, but the animal feedingstuffs supplement home-grown crops for the production of such commodities as butter, cheese, condensed milk, eggs, bacon, and meat products, which not only satisfy domestic requirements but allow a surplus for export. The only crop exports of any consequence are those of seed potatoes and potato products such as flour and meal. This export trade is of great importance to the country, and in 1952 represented a sum of £340 million, or 44 per cent of the total export trade of the country. The import of agricultural products amounted to £180 million, or 21 per cent of the total imports.

A Complex System of Price Supports To achieve this result, the farmers in the Netherlands have to produce and export at competitive prices, and for their main exports this means producing in competition with the Danes. But by contrast with Denmark, whose farmers receive no support from the Government, there is in the Netherlands a complex system of price supports which is made more complicated by the diversity of the types of farming. Agricultural policy in the

Netherlands is intended to provide a guaranteed standard of living to farmers who manage their farms efficiently and whose farms can be justified from a social and economic point of view.

In putting this policy into practice, the Government take great care to try and avoid a rise in the cost of production which would make their exports uncompetitive. In some cases the Government itself has taken over the exports, notably in the case of bacon, which receives an export subsidy; and this is justified on the grounds of preserving an important existing outlet for the future.

The Government have accordingly divided farm products into separate categories. In the first category are the products of great national interest, the prices of which are fixed so as to give a return of the costs plus a reasonable profit to the producers. The products in these groups include wheat, rape seed, sugar beet, and milk for liquid consumption. In the second group are commodities which, in the view of the Government, need stable rather than guaranteed prices but require conditions under which they can be produced on an average farm without loss. The products concerned are milk for manufacturing, meat, coarse grains, and potatoes. The remaining products, including horticultural crops, are left to the risk of producers themselves.

The machinery for putting these principles into practice consists of a series of Trade Boards for all the main commodities with statutory powers to control production, prices, marketing, and imports and exports. Working side by side with these regulatory bodies are a series of Purchase and Sales Offices. The method used to regulate prices and other matters vary according to the commodities concerned and, in the absence of any general directive, each agency is left to work out its own method of operation.

It can be seen, therefore, that agriculture in the Netherlands is very carefully organized, but at the present moment the Government is not paying out large subsidies. The only commodity which receives a substantial subsidy is milk for liquid consumption, but this is paid primarily to keep down the cost of living rather than to help the farmers. The Government maintain an Agricultural Equalization Fund, which receives its income partly from levies from imports but mainly from a direct Government grant. The subsidy on liquid milk is paid from this Fund, as is also the subsidy on the bacon exports to the United Kingdom, which is necessary because the price of bacon from Denmark is lower than the internal price of pork in Holland. In the case of dairy produce, the farmers themselves contribute to a special Dairy Fund, which can be used to help exports if the price realized is lower than the price on the home market.

With this background of security, it is not surprising that of recent years farming in the Netherlands has been prosperous, and yet costs have been kept down, mainly through a rigid control of wages, which affects not only agriculture but the whole of the community. But a point is now being reached where costs, particularly wages, are rising, and unless prices for exports rise accordingly, there will have to be some system of levies or subsidies to assist the export trade. But for the moment the farming is both prosperous and efficient in terms of low costs.

Two-fifths of Land under Arable Crops One of the persistent problems in the agriculture of the Netherlands is the position of the small farms on the extensive areas of light land to the east and south of the country. The principal crop on this land is rye,

and the recent drop in the price of rye has created special problems for farmers in these areas. The Government is anxious to maintain a healthy pig and poultry industry on these farms, as this intensive form of production helps to counterbalance the low inherent fertility of the land.

On the other types of land, the most important crop is potatoes, which are grown both for consumption and for processing. One feature of potato growing in Holland of recent years has been the development of potato stores in which the temperature can be kept low to avoid deterioration of the tubers during storage. This development has also had the effect of keeping surpluses off the market in the autumn months. In 1953, the storage capacity for potatoes amounted to 160,000 tons, and stores to hold a further 40,000 tons were under construction in 1954.

Since the war, the growing of fodder crops for animal consumption has been much encouraged as one method of saving foreign currency for the import of feedingstuffs. An interesting development has been the growing of maize for grain. By using some of the American hybrids and crossing them with local varieties, maize can now be grown with a reasonable assurance of a ripe crop of grain. By 1952, 35,300 acres of maize were grown, and though the area declined in 1953, due partly to the floods early in that year, maize can now be regarded as having established itself as a regular farm crop. Even in the bad weather of 1954, the maize crop matured and gave a good yield of grain. One other feature of farming in Holland is the extensive use which is made of catch crops sown on the stubble after harvest, especially on the light land to the east. .The two most important crops grown in this way are stubble turnips and stubble clover, and the total area under stubble catch crops in 1952 was some 260,000 acres.

Intensive Livestock Production The most important branch of livestock production is dairying, which is mainly carried out in areas that are almost entirely under permanent grass. Many of these areas are low-lying, intersected with ditches and drains, and are incapable of being used for arable farming. The high water-table ensures a regular growth of grass which is virtually independent of the season. The total cattle population is about 3 million, half of which are cows in milk. The average milk yield per cow is 850 gallons, with a fat content of 3.66 per cent. A large proportion of the milk produced is used for making butter, cheese, and various forms of milk powder and condensed milk, about two-thirds of which is exported: in the case of condensed milk alone, the figure is over 90 per cent.

Pig production tends to be concentrated on the smaller farms and is mainly for home consumption, but since the end of the war in 1945 there has been an expanding sale of bacon to Great Britain. Other sales of pigs, mainly fat pigs, are chiefly to Germany. Egg production is also a feature of farming in Holland, and the main export of eggs is also to Germany, although some are sent to the British market.

One aspect of farming in Holland which is associated with its high degree of intensity is the extent to which fertilizers are used. Comparative figures show that Holland uses more nitrogen, phosphate and potash per unit of cultivated land than any other country in the world. This is especially the case on permanent grass, which is made very productive by the generous use of fertilizers. In the matter of feedingstuffs, figures for 1952-53 show that of the total feedingstuffs available, 87 per cent were home-grown and only 13 per cent were imported.

Horticultural Output Valued at £60 Million Holland has long been considered as of great importance in horticulture, and, as mentioned earlier, 4 per cent of the land is under horticultural crops, but they contribute 13 per cent of the agricultural output. In 1951, the horticultural output was valued at £60 million, of which produce to the value of £48 million was exported. Most of this is marketed through auction marts, which are fitted with electric auction clocks on which a pointer falls from higher to lower figures. When a pointer indicates a price which a purchaser is prepared to pay, he can stop the clock by pressing a button in front of his seat. An illuminated number on the clock shows who has purchased the consignment.

To avoid a slump in prices because of a glut, the Association of Auction Marts has fixed minimum prices. If the price goes lower, the produce is withdrawn and growers are paid a certain percentage of the minimum price, which varies according to the type of produce. The money comes from a compensation fund, which is built up in times of good prices by a levy on the produce sold.

The development of horticulture in Holland is partly traditional, but it has also been influenced by the shortage of arable land in a country with such a high population. Many farmers' sons who, in normal circumstances, would have been farmers rather than market gardeners, make a living from this concentrated form of production.

Space does not permit of more than a reference to the extensive work of land reclamation which is being carried out in Holland. This is of supreme importance in a country where the pressure of population is very severe, and the work so far completed and the schemes in contemplation will provide an additional half a million acres of very fertile soil to the farmlands of Holland. The disastrous floods in February 1953 brought out very vividly the dangers under which much of the farming is carried out, and there is now a proposal to build a dyke beyond the islands in the south-west of the country, which it is hoped would prevent the recurrence of such a disaster.

Low Production Costs Agriculture in the Netherlands has a dual responsibility. It must first of all feed the large population of the country, and at the same time produce a surplus at economic prices for exports. To enable this to be done, the Government has provided a background of stability, but the emphasis has been placed on low costs of production rather than on subsidies to farmers. This has given a feeling of security to the industrious Netherlands farmer, and he now emerges from the period of food shortages to conditions of free marketing with full confidence in his ability to produce and sell at competitive prices. Tribute should also be paid to the initiative of the middleman who, despite the existence of large markets almost on his doorstep, has gone out into the world and found new markets for farm products. Thus agricultural exports from the Netherlands are sent to many overseas markets, and this fact makes the country less dependent on the continuance of any one market.

Next month Mr. Ronald Ede writes about the agriculture of Sweden.

CLUN FOREST FARM

PROGRESS REPORT

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Four years ago, an account was given in this Journal* of the extensive land reclamation work being undertaken on the upland farms in the Clun Forest area and, in particular, of the way in which the problem was being tackled on Mr. R. E. Morris's Weston Farm. Subsequent events have shown that this work was merely the forerunner to much greater progress in the hills.

UNDER the Hill Farming and Livestock Rearing Acts, many farmers and owners on upland farms in the Clun Forest area are now engaged in carrying out grant-aided improvements schemes on their farms. The work being undertaken includes the construction, repair and improvement of farmhouses, cottages and farm buildings, the repair of roads, provision of electricity, drainage and water supplies, fencing, and, in fact, everything necessary to put the farms in proper working order. Mr. R. E. Morris, who farms 400 acres in the district, is one who has taken full advantage of the facilities available. Mr. Morris was not slow to realize that there was little point in improving grazings on the farm unless all other factors were geared up to keep pace with that improvement. More grazing meant more cattle to eat the grass, and that brought with it the problem of stock accommodation, especially the wintering of an increased head of cattle. There was also the problem of storing the additional fodder which the land proved capable of growing. Only by carrying out a *comprehensive* scheme of improvement, he felt, could the full productive capacity of the farm be realized. Accordingly, in 1950, he embarked upon such a scheme approved under the 1946 Hill Farming Act.

The beginning of this improvement work was dealt with in an earlier article in this Journal; but last year marked the completion of the scheme, and the present time is therefore opportune to bring the picture up to date, to review the work done in the past few years, and to report on the effect the improvements have had on farm production.

The Clun Forest comprises that part of Shropshire situated in the extreme south-west corner of the county, lying mainly west of the little town of Clun. The area has roughly the shape of an equilateral triangle delineated on two sides by the county boundary bordering Radnorshire and Montgomeryshire, and on the third side by the road linking Bishop's Castle, Clun and Knighton.

Topographically, the area is predominantly upland in character, with flat-topped hills rising to 1,300 feet and intervening valleys falling to around the 600 feet contour. The climate is characterized by fairly high rainfall which, in normal seasons, is between 35 and 40 inches a year. The geology shows some slight variation. The deposited soils on the riverside land are naturally fertile, while on the slopes of the valleys there are some good,

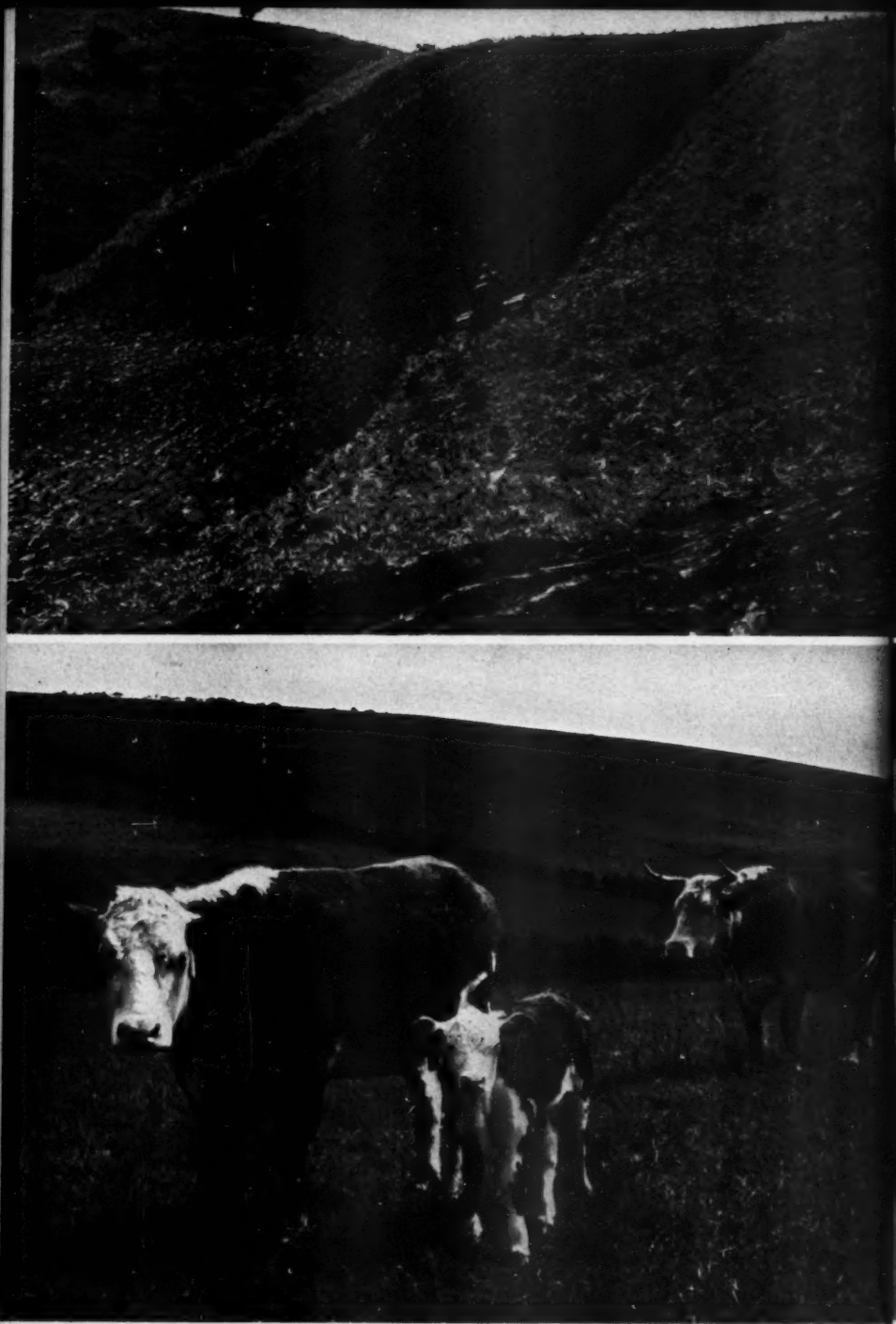
* Clun Forest Farm. J. W. REID, 1951, **57**, 513-7.

Photos: *Common Ground (1951) Ltd.*

Clun Forest Farm.

The Clun Valley from Weston Farm.

The Welsh ewe flock has been completely replaced by a much improved Clun cross.



Photos: *Common Ground (1951) Ltd.*

Clun [illegible] Far

Ploughing bracken-covered hill land for the pioneer crop of rape.

Three generations of Herefords on a new ley. Dehorning is now a regular practice.

Photos: *West Midland Photo Services Ltd.*

Farm.

Improvements to the farm buildings include the construction of a new yard and barn.

Simplified feeding. A raised central feeding passage runs the whole length of the new yard.

IMPROVEMENT OF A SOMERSET ESTATE BY LEY FARMING

(Article on pp. 530-3)

A home - made cattle crush from estate timber.

Ten - week - old Large Blacks at Barley Wood.

Photos: *George Jarrett*

Capt. Wills has had many show successes with his Ryeland rams.

workable loams, which respond well to generous fertilizing. As one would expect, the poorer soils are found on the hillsides. The hilltops, when bracken covered in their natural state, are often fertile (though sometimes in need of drainage) and frequently provide a surprising depth of good red loam. Where heather prevails, the soil is of the poorest type and often peaty in texture.

The Clun Forest area suffered greatly during the agricultural depression. Contributory factors to the miserable decline in farming were the low prices offered for store cattle, which made cattle rearing uneconomic, the dying out of the hill pony which had provided a subsidiary yet valuable income to the farmers, and the gradual drift to the towns of local labour—especially the younger people, who went in search of employment and the amenities of urban life. The expansive hilltops clad with flourishing bracken, gorse and thorn, and the derelict and often deserted farmsteads, were indeed a legacy of those days, which we hope will never return.

A New Spirit in the Uplands Today there is a new spirit in these uplands—a new initiative and enterprise. Since 1940, and to a much greater extent since the end of the war, the Clun Forest has sprung to life again. The face of the countryside has changed, and a new agriculture prospers. In November 1946, the Hill Farming Act made provision, *inter alia*, for promoting the rehabilitation of hill farming land. Under the Act, financial assistance amounting to half the cost of the work done was made available to owners and occupiers of hill farms in the United Kingdom who were willing to carry out schemes for the improvement of their farms. The work covered may include any of twenty-three different items, such as the repair and modernization of farmhouses, cottages and farm buildings, and the construction of new ones, road construction and improvement, work on bridges, fencing, drainage, water and electricity supplies, the reseeding, manuring and liming of grazings, and the planting of shelter-belts.

The Act laid down that schemes must be comprehensive. They have therefore to include as a minimum all the work necessary to put the farm into proper working order; they had also to be submitted within five years of the date of the Act.

In March 1951, a further measure—the Livestock Rearing Act—received the Royal Assent. Among its objects was the extending and amending of certain provisions of the "principal" Act (the Hill Farming Act). Under this second Act, both hill farming land and other livestock rearing land in the same general areas were made eligible for improvement grant. Livestock rearing land was defined as "land situated in an area consisting predominantly of mountains, hills or heath, being land which is, or by improvement could be made, suitable for use for the breeding, rearing and maintenance of sheep or cattle but not for the carrying on, to any material extent, of dairy farming, the production, to any material extent, of fat sheep or fat cattle, or the production of crops in quantity materially greater than that necessary to feed the number of sheep or cattle capable of being maintained on the land". The new Act also extended the period during which schemes might be submitted from five to ten years, making the final date for application November 6, 1956.

Both these Acts have a fairly wide bearing on the Clun area and have indeed contributed in no small measure to the great farming transformation which has been effected. Mr. Morris is typical of many upland farmers who have taken full advantage of the assistance which this legislation has made available to them.

CLUN FOREST FARM

An Improvement Scheme is Born Mr. Morris and his family came to Weston Farm from Radnorshire in 1939. The tenancy then comprised 462 acres, of which 62 acres were riverside land, 169 acres were enclosed land, 167 acres open hill (partly covered with bracken, gorse and heather), and 64 acres were classified as rough grazing. Land under arable cultivation at that time accounted for only 20 acres. Most of the grassland was poor and greatly in need of improvement. In 1948 the farm was put up for sale in two lots, and Mr. Morris became the new owner of all but the 62 acres of riverside land.

On entering the farm in 1939, Mr. Morris first set about improving the grazings. The aim was to increase the acreage of enclosed land under rotational cropping, and this was achieved by ploughing about 20 acres every year. In 1945 a start was also made on ploughing and fencing the open hill, and the same policy of doing a small area each year was pursued. By 1950 the whole of the ploughable land on the hill had been ploughed and cropped, while the enclosed land was cropped as follows:

	acres
Tillage	74
Temporary grass	44
Long leys	49
Permanent grass	36

Woodland and scrub accounted for a further 20 acres.

Little had been done to improve the farmhouse and buildings; drainage, fencing, more reseeding, a water supply and a sheep-dipping pen, besides shelter-belts, were all needed. Accordingly, in 1950 Mr. Morris applied for assistance under the Hill Farming Act, and a comprehensive improvement scheme was approved and begun in July of that year.

The farmhouse at Weston is of the traditional stone type: the stone is of local origin. The state of repair in 1950 was generally poor and, although the house was structurally sound, it was greatly in need of modernizing and general improvement. This work was therefore given priority in the scheme, and a start was made in late 1950. The work included the provision of a new bathroom and a lavatory with drainage to a septic tank. The farm buildings were, on the whole, in quite good repair, but they were totally inadequate for the stock which Mr. Morris was then carrying. Fodder storage space was also insufficient, so provision was made for the construction of a new covered yard to house 65 cattle and for a four-bay Dutch barn for hay and straw. This work was also completed in 1950.

An interesting feature of the new yard and barn is the economical layout designed to simplify feeding and save labour. The barn has been built at right-angles to the end of the yard a short distance away from it and with a lean-to abutting on the yard. The route from the Dutch barn is thus both short and covered. On the inside of the yard and at the same end as the barn, space has been provided for the storage of roots and fodder. Feeding is done by means of a raised central feeding passage running the length of the yard. Manure is taken out direct to the land through gates provided at the other end of the yard.

Land Reclamation Policy Continued A peculiar feature of the hill land in the Clun Forest is that parts of it very often need draining. Such was the case on the open hill attached to Weston. Water from a number of small springs found a resting place in the

comparatively flat basins on the hilltops, and about 18 acres of otherwise useful land were rendered unploughable. Once the water was piped and led off to the natural outfalls in the deep ravines, this area was successfully brought into cultivation with the rest of the hill.

Work on the reclamation of the open hill continued under the scheme. Whereas almost the whole had been ploughed before 1950, only 40 acres had actually been laid down again to grass. Under the scheme, provision was made for the seeding down of a further 135 acres, and all the work in this area has now been completed. Treatment of different portions of the hill has varied slightly, but in the main the procedure has been to plough, pioneer crop for one season (in some cases two), and then follow up with direct reseeding. Ploughing usually took place in the autumn and winter and the land left in the furrow until the spring. It was then disced several times to secure good consolidation and a reasonable seedbed. At this stage, 4 tons ground limestone and 10-20 cwt. basic slag per acre were applied. Mr. Morris is a firm believer in the use of basic slag on this hill land and his leys receive yearly applications of 10 cwt. per acre, but as fertility has been built up with extra stock, this dressing has been reduced to 6 cwt. The first crop was rape, sown with a small dressing of nitrogen and the crop eaten off by sheep. If the same area was not pioneer cropped again the following year, the waste left by the sheep was ploughed in on a shallow furrow in spring and the land disced, rolled and seeded down.

On the subjects of seeds mixtures, it is still too early from a long-term point of view to be dogmatic about the best type. For the moment it is perhaps sufficient to say there are indications that on land which previously formed part of the open hill the high-yielding seeds mixtures suited to lowland conditions may not be the best.

To maintain the sward of the hill, Mr. Morris adopted a policy of controlled grazing. The hill was fenced off into four smaller units and each grazed in turn. In all, over two miles of fencing were erected.

The exposed position of the hill also necessitated the provision of shelter. This has been met by the planting of three shelter-belts at a gross cost of £73 each. They consist of L-shaped mixed plantations of one chain width containing Sitka spruce and Scots pine, together with a little European larch. Before planting in the spring of 1954, the sites were ploughed and disced. The trees* were then notch-planted, with 5 feet between trees and rows. Each plantation was protected with a stout rabbit- and stock-proof fence, constructed of 42 inch wide 18 gauge netting, with a strand of barbed wire placed about 6 inches above the top of the netting. All the work on the shelter-belts was done by the family staff. It is significant that, even at this early stage, the cattle on the hill lie on the sheltered side of the plantations.

Other improvements include the installation of water supply to the farmhouse and buildings, the provision of a new sheep-dipping bath to replace the old, badly-sited one, and road repairs to the farmyard and its approach.

The total cost of these improvements works out at approximately £22 per acre, or £11 per acre after allowing for grant-aid. One individual item of interest is the new covered yard, which cost £2,824 gross, or approximately £5 17*s.* per square yard. The actual gross fixed equipment costs were £14 4*s.* per acre. This figure covers all the items, except the reseeding of 107 acres.

* The plants were two years in the seedbed and one year in the nursery lines.

Tremendous Increase in Stocking In the first year of Mr. Morris's occupation of Weston the farm carried 12 Hereford breeding cows, 23 followers and 160 Welsh and improved Welsh ewes. By 1944, these figures had been brought up to 18 breeding cows, 35 followers, and 660 sheep, which was about as much as the farm could carry without improvement. Today, the farm carries 40 Hereford breeding cows and 143 followers, together with 270 Clun breeding ewes, 230 ewe hoggs, and 466 lambs.

The cattle policy is for each cow to rear one calf. The cows calve down in spring and suckle their calves on grass throughout the summer. Formerly, the young stock were kept on and sold at 18 months old. Present policy is to carry the store cattle to two and a half years before selling. With the present trend of demand for smaller joints, it may well prove wise to revert to the policy of selling younger stores if the lowland feeders so require, and this will mean increasing the herd to breed more calves to sell younger. All replacements in the breeding herd are home-bred.

The former sheep policy was to breed from hardy hill type Welsh ewes by mating with a Clun ram, but today the Welsh ewe flock has been completely replaced by a much improved Clun cross ewe flock, which has been built up over a period of years. A small number of the Welsh ewes were sold out each year—the last in August last year. The present Clun cross ewes are mated with Clun rams to lamb down in March and April. Wether lambs are sold off by Christmas and ewe lambs are kept for breeding. Some of the ewes are sold as yearlings, but the majority of the flock sales consist of two-year-old ewes, which are disposed of at the local Knighton sheep sales.

Future stock rearing policy is to build up the number of breeding cows to fifty, to rear their followers, and to maintain the ewe flock at its present number.

So far, there has been little or no reappearance of bracken on the grassland. Rushes have proved troublesome, especially in some of the wetter parts of the open hill land, but experimental work on eradication by the use of growth-regulating weed-killers is in progress. This open hill also had the reputation in the old days of being indifferent cattle grazing land, and there are, in fact, some indications that the establishment of apparently high quality leys (a relatively easy matter) does not necessarily convert this type of country into good cattle grazing land. However, this subject is being watched closely both by Mr. Morris and his sons (who are all good stockmen), as well as by other experts.

Mr. Morris is indeed fortunate in having a good labour supply at his disposal, for five of his six sons are at home and work on the farm. All have taken a very keen and energetic interest in the development of the farm. The farm still lacks accommodation for labour and urgent consideration is being given to the provision of at least two cottages. The temporary nature of human life and its constant change demand that this problem should be looked at in the abstract. Obviously if a farm of this size is to continue its usefulness, the provision of accommodation for labour—other than the farmhouse—is vital.

Let no one think, however, that the family farm tends to develop an individual interest to the exclusion of outside or public concerns. The eldest son of this yeoman family is a past Chairman of the local National Farmers' Union Sub-Branch and a member of the Agricultural Executive Committee Hill Farming Sub-Committee. The farm has been a popular one in the Farm

Adoption Scheme run by the Association of Agriculture—some 400 schools study its seasonal management. Many more schools and teaching establishments, both in this country and overseas, compare its development with others included in the same scheme—an excellent way of cultivating rural interests in urban populations.

Having restored his farm to proper working order, Mr. Morris is the last person to feel complacent about it. He realizes that land improvement can never reach finality, and that fertility once built up must be maintained and, if possible, pushed up still further. That is the future programme on Weston Farm and, indeed, on many other farms in the Clun Forest district, for as Mr. Morris modestly says, "What we have done has also been done by scores of others".

LONGWOOLS AND HALF-BREDS COMPARED AT BICTON

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Trials carried out over a period of five years at the Devon School of Agriculture and Horticulture indicate that lambs by a Dorset Down ram out of Half-bred (Border Leicester × Cheviot) or Devon Longwoolled are much more profitable than those from a pure-bred Devon Longwoolled flock. The cross-breds also proved superior for winter fattening.

WHEN the Devon School of Agriculture took over a farm in the autumn of 1946 it was decided that the sheep should be of the Devon Longwoolled breed, and a flock was established by the purchase of approximately 100 registered ewes. They were collected from six different flocks and were good representatives of the breed. However, the lamb crops produced during 1947 and 1948 were very disappointing, being slightly below 100 per cent of the ewes put to the rams, and it was therefore decided to reduce the size of the Longwoolled flock to 60 and to establish another of 40 Half-bred (Border Leicester × Cheviot) ewes during the autumn of 1948. A supply of Half-breds was found on Exmoor, thus avoiding the heavy cost of transport which would have been incurred by buying them from Scotland. Since 1948, the strength of the Longwoolled flock has been maintained by purchase in the early years and home-bred shearlings in later years. Replacements for the Half-bred flock have been bought, when necessary, as four-tooth and six-tooth ewes. The existence of two flocks presented an opportunity to conduct a simple comparative trial, which was continued for the five seasons 1948-53.

A representative half of the Longwoolled ewes were bred pure, whilst the other half, together with the Half-bred ewes, were divided as fairly as possible between two Dorset Down rams. The Dorset Down was selected

because at the time it was a popular ram in the neighbourhood of the School. We thus produced three types of lamb—pure Longwoolled, Dorset Down × Longwoolled, and Dorset Down × Half-bred. The numbers of ewes concerned are given in Table 1.

Table 1

Grouping of Ewes at Tupping Time

	Pure Devon Longwoolled	Devon Longwoolled with Dorset Down Ram	Half-bred with Dorset Down Ram
1948-49 ...	30	20	40
1949-50 ...	30	31	37
1950-51 ...	37	31	42
1951-52 ...	33	33	35
1952-53 ...	34	33	35
Total ...	164	148	189

Careful records were made throughout of the lambs born: the dates of birth; the number of lambs reared; and the numbers, weights and values of lambs sold fat off the ewes. We also recorded the weights and values of stores, both sold and retained, at the end of September. The fleeces clipped from ewes and from sucking lambs were weighed and sold separately, so that values could be apportioned to the three ewe flocks. The depreciation suffered by the ewe flocks was calculated carefully in order that simple financial statements of gross income could be drawn up. To make the factual records as complete as possible, we folded representative groups of each type of lamb on turnips and swedes during the last four winters of the trial.

The ewes were run as an ordinary lowland grass flock with no unusual or elaborate treatment. The system of management and the dates of annual operations were kept steady throughout the five years. Aspects of management which may be considered to have had a bearing on the trial are, however, worth describing. Flushing was by folding on rape for two weeks before putting in the rams. It was expected from the outset that the Half-bred ewes would be later in lambing than the Longwoolled, but as a compromise rams were put with the ewes as nearly as possible to September 14 each year. Whilst with the rams, the ewes were on good autumn grass (usually new leys), and the three groups were rotated so that as far as possible all were given equally good keep. Winter feeding in this district of mild climate was reduced to a minimum. During this period of the year all three groups were run together and received a little hay and kale or mangolds when necessary. To prepare ewes for lambing, they were drawn out in groups at appropriate times and given a little concentrated food, amounting to not more than ½ lb. per ewe per day, as a steaming-up ration for 2-3 weeks before lambing. As soon as possible, ewes and lambs were run on to early seeds, and concentrated feeding continued at ½ lb. until within a few days either side of March 20. After this date, the concentrates were given direct to the lambs in a creep.

Longwoolled Lamb Earlier but Rear Fewer As will be seen from Table 2, approximately three-quarters of the Longwoolled ewes produced their lambs before the Half-bred ewes had made a fair start. It is important that this fact should be taken into consideration when growth rates and numbers sold as fat lamb are discussed later. It had been suggested that the Half-bred ewes might become acclima-

tized to mild conditions and change their ways, but the evidence we have collected proves that their refusal to lamb early is inherent and not affected by habitat. As a point of interest, there is no doubt that the shepherd's work is easier with the Half-bred than with the Longwooled. The former required virtually no assistance when lambing.

It is of little value as evidence, but interesting to note, that since the conclusion of the trial—that is, during the 1953-54 lambing season—we put rams in a little earlier and found that the few Half-bred ewes which lambed at early dates all produced singletons.

Table 2

Lambings as Percentages of Totals

(Averages of five years)

	Pure Devon Longwoolled	Dorset Down × Devon Longwoolled	Dorset Down × Half-bred
On or before Feb. 23	78	70	10
After Feb. 23	22	30	90

The numbers of lambs reared have been expressed as percentages of the numbers of ewes going to the ram. The figures, given in Table 3, show strange variations from year to year, but over the five-year period there is a significant difference between the two breeds of ewe. The Longwoolled ewes have reared approximately 125 per cent and the Half-bred ewes approximately 150 per cent. As would be expected, the numbers reared by the Longwoolled ewes breeding pure were not significantly different from those reared by similar ewes put to Down rams.

Table 3

Lambs Reared, as Percentages of Ewes put to Ram

	Pure Devon Longwoolled	Dorset Down × Devon Longwoolled	Dorset Down × Half-bred
1948-49	110	120	140
1949-50	130	126	122
1950-51	132	110	145
1951-52	100	127	166
1952-53	153	133	171
Weighted Averages ...	126	124	148

Cross-bred Lambs Grow Faster All lambs were weighed regularly as they approached saleable size. Except for some of the pure Longwoolled ewe lambs, all those that reached a minimum of 80 lb. alive before prices fell were sold off the ewes. In order that the comparisons of growth rates shown in Table 4 should be fair to all types of lamb, the numbers and percentages quoted for the pure Longwoolled do not include ewe lambs retained for breeding.

It will be seen that the Dorset Down rams produced lambs out of the Longwoolled ewes which were better doers than the pure-bred lambs, and that the Half-bred ewes, in spite of having larger numbers to suckle and a later lambing time, were able to bring along their progeny at a better rate than were the Longwoolled ewes. This was achieved in spite of inequality in concentrate consumption, the feeding of which to both breeds had to end, for practical reasons, early in July. It had, however, been started approximately three weeks earlier to the Longwoolled ewes than to the Half-breds.

At the end of each season some lambs were sold as stores, but we retained for folding on turnips and swedes, a representative sample of each of the three types. The late September weights of all lambs were recorded, and the selling prices of the surplus stores used to assess the cash values of those retained. The ewes to be carried forward for another breeding season were also valued at the end of September, using as bases the selling prices of drafts and the purchase prices of newly-introduced ewes.

Table 4

Disposal of Lambs

	Pure Devon Longwoolled	Dorset Down × Devon Longwoolled	Dorset Down × Half-bred
Sold as "early" lamb ...	39*	94	144
Sold as stores	34	26	71
Retained for breeding ...	83	—	—
Retained for folding ...	49	63	65
Deaths	1	—	—
Total No. reared ...	206	183	280
"Early" lambs as percentage of totals ...	36*	51	51
Weighted averages of grading weights (*lb.*) ...	40	43	41

* The 39 sold as early fat lamb represent 36 per cent of the potential early sales: that is, of all the lambs born in the first year and the wethers for the remaining years.

Longwoolled Produce Heavier Fleeces The clips from the two breeds of ewe were weighed and sold separately and credited accordingly. Similarly, the wool taken from sucking lambs was weighed and the income apportioned to the three flocks. It will be seen from Table 5 that the Longwoolled ewes produced much heavier fleeces (approximately 13 lb.) than the Half-breds (6½ lb.). Wool prices fluctuated during the five years of the trial, but on average the Longwoolled ewes produced clips worth £2 1*s.* 4*d.* each, against only £1 4*s.* 3*d.* for the Half-breds. The credits for lambs' wool were slightly higher to the Half-breds, due to the larger numbers of lambs clipped.

Table 5

Wool Yields and Values

(Weighted averages for five years)

	Pure Devon Longwoolled	Dorset Down × Devon Longwoolled	Dorset Down × Half-bred
YIELD			
Clip from ewe fleece (*lb.*)	13¼	13¼	6¼
Price of ewe fleece (*d.*)	38	38	47
VALUE	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
Ewe fleece	2 1 4	2 1 4	1 4 3
Wool from sucking lambs (per ewe)	14 10	10 6	12 8
	2 16 2	2 11 10	1 16 11

Half-breds More Profitable Depreciation, or cost of maintaining a ewe flock, is easily determined where only purchases and sales are concerned, but in the case of our permanent flock of Longwoolled ewes, it was necessary to value the shearlings at introduction. This was done as fairly as possible by taking into consideration their market

value at the time and making a conservative estimate of the cost of production. In spite of some fluctuation in prices during the five years, and considerable variation in annual depreciation, we found that over the five-year period there was no significant difference between the two types of ewe. Depreciation was £1 2*s.* 10*d.* per Longwoolled ewe and £1 2*s.* 8*d.* per Half-bred ewe (see Table 6).

Table 6

Depreciation

	Devon Longwoolled				Half-bred			
	No.	£	*s.*	*d.*	*No.*	£	*s.*	*d.*
Valuation at Sept. 1948	50	380	0	0	—	—	—	—
Purchases—five years	40	405	0	0	80	620	0	0
Home-bred replacements—two years	37	407	0	0	—	—	—	—
Total Cost	127	1,192	0	0	80	620	0	0
Sales—five years	76	488	18	11	42	208	19	1
Valuation at Sept. 1953	41	347	10	0	28	197	0	0
Deaths—five years	10	—	—	—	10	—	—	—
Total Value	127	836	8	11	80	405	19	1
Depreciation		355	11	1		214	0	11
No. of ewe-years (Table 1) ...	312				189			
Depreciation per ewe-year ...		1	2	10		1	2	8

We made no attempt to determine actual profits, because it was virtually impossible to assess costs. An attempt to measure, for example, the grass consumed by ewes and lambs, and to give it a cash value for the three groups separately, would have been useless. A simple statement of the cash value of output can therefore be taken as a summary of the trial.

Table 7

Cash Analysis

(Per ewe per year—weighted averages)

	Pure Devon Longwoolled			Dorset Down × Devon Longwoolled			Dorset Down × Half-bred		
	£	*s.*	*d.*	£	*s.*	*d.*	£	*s.*	*d.*
"Early" lambs sold ...	1	5	3	3	17	6	4	9	0
Stores sold	1	1	1		17	11	1	19	7
Stores for breeding (valuation)	3	0	8		—			—	
Stores for fattening (valuation)	1	14	4	2	11	6	2	1	8
Wool—ewe	2	1	4	2	1	4	1	4	3
—lamb		14	10		10	6		12	8
Total per ewe	9	17	6	9	18	9	10	7	2
Depreciation	1	2	10	1	2	10	1	2	8
Gross output per ewe per year	8	14	8	8	15	11	9	4	6
Margins over pure Longwoolled ewe		—			1	3		9	10
Margins per 100 ewes ...		—		6	5	0	49	3	4

When studying Table 7, the following possibilities should be considered:

(a) Summer prices for lamb may in future favour breeds which can bring their lambs to the butcher at early dates. In this respect, there is little to choose between the Half-bred ewe and the Longwoolled ewe crossed with a Down ram.

(b) Wool prices may continue to fluctuate. They are now higher than for the years of the trial, and are thus in favour of the Longwoolled ewe.

(c) Fat ewes have been easy to sell. In future, prices will probably run against the heavier breeds such as the Longwoolled.

(d) It has been suggested that we could keep more than 100 Half-bred ewes on the food consumed by 100 of the heavier Longwoolled breed. We agree, and must therefore assume that the "profit" margin in favour of the Half-bred was considerably greater than the £49 per 100 ewes shown in the table.

Cross-breds Superior in Winter Fattening Trial A trial on the winter fattening of hoggs was conducted for four winters only (1950-54), as none of the lambs born in 1949 were retained on the farm. The total number of hoggs involved was 177, including 49 pure Longwoolled, 63 Dorset Down × Longwoolled and 65 Dorset Down × Half-bred. The three types were always run together as one flock and there was little variation in treatment from year to year. They were run on grass during October and November, and injected with pulpy kidney serum shortly before going to fold early in December.

At the start of folding, hoggs were given hay and turnips *ad lib.*, but after a short time the latter were replaced by swedes. Roots were always put through a chopper. During the fourth winter only, a representative half of the hoggs were given a little concentrated food, but this side issue has no bearing on the comparison of types, and results are not quoted here. All the important and comparable records are included in Table 8 as weighted averages for the four years.

Table 8

Wintering of Hoggs

(Weighted averages for four years)

	Pure Devon Longwoolled	Dorset Down × Devon Longwoolled	Dorset Down × Half-bred
Number of hoggs per year	12	16	16
L.W. at end of Sept. (*lb.*) ...	102.4	104.8	104.5
L.W. at start of folding (*lb.*)	110.6	112.6	113.6
L.W. at end of folding (*lb.*)	133.8	137.8	139.7
Grading weight (*lb.*) ...	67.3	70.6	71.5
Killing-out percentage ...	50.3	51.2	51.2
Weeks folding	14.7	13.4	13.2
L.W. increases Sept. to sale (*lb.*)	31.4	33.0	35.2
L.W. increases folding (*lb.*)	23.2	25.2	26.1
L.W. increases per week folding (*lb.*)	1.58	1.88	1.98
	£ *s.* *d.*	£ *s.* *d.*	£ *s.* *d.*
Value at end of Sept. ...	5 14 10	6 0 11	6 1 4
Value at end of folding ...	9 13 4	10 0 5	10 2 5
Increases in value	3 18 6	3 19 6	4 1 1

The liveweight increases during folding, the rates of liveweight gain, and the killing-out percentages, all indicated that the Dorset Down × Longwoolled hoggs were better feeders than the pure Longwoolled, and that the Dorset Down × Half-bred was, if anything, even better. The increases in cash values during folding followed the same order, but the differences

between the three types of hogg were only slight. The reason was the relatively low value of the pure Longwoolled hoggs in September. All the values, however, were based on the actual selling prices and known live weights of comparable stores. Our results do in fact show that the lower market value of the Longwoolled store in September reflects the buyers' expectation of relatively poor fattening qualities.

Another question arises in that appreciation in value during feeding is not a true measure of profit. It is reasonable to assume that the length of the folding period is a measure of food and labour costs, and also that protracted folding may delay cultivations for the crop which is to follow. We are therefore forced by our results to conclude that the extra ten days taken by the pure Longwoolled hoggs made them a less profitable proposition than the Down crosses out of Longwoolled or Half-bred ewes.

Summary Half-bred ewes reared more lambs than Longwoolled ewes. They lambed later but were better milkers and brought more lambs to the butcher in time to earn the "early" summer prices. To some extent, the more valuable fleeces produced by Longwoolled ewes offset the smaller income from lambs, but the sales from Half-bred ewes were 9-10*s*. per head per year greater than from the Longwoolled ewes. Profit margins were probably greater than these figures suggest.

For winter fattening, a Dorset Down ram used on Longwoolled ewes produced a more profitable hogg than the pure Longwoolled. There was no significant difference between the fattening properties of a Dorset Down × Longwoolled and a Dorset Down × Half-bred hogg.

INTERACTION OF NITROGENOUS FERTILIZER AND WHITE CLOVER IN UNGRAZED SWARDS

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Where herbage is cut and carted off, the nitrogen so lost has to be made good. Trials at Sutton Bonington were designed to ascertain whether white clover or nitrogenous fertilizer were likely to give the best results.

ALTHOUGH there is abundant evidence to show that both white clover and nitrogenous fertilizers materially influence the yields of herbage, opinion is divided regarding their relative contribution and value. In New Zealand great store is set by the contribution from white clover which, under conditions of intensive grazing, has been estimated to be equivalent to 2,000 lb. sulphate of ammonia per acre (1). In Holland, generally heavy dressings of fertilizer nitrogen are applied, and in Britain an attitude which has been described as "a typical British compromise" (2) predominates in the minds of all except a few extremists. These differences of opinion are primarily due to differences in climate and, to a certain extent, differences in the types of swards or in the manner of utilizing the herbage.

INTERACTION OF NITROGEN AND WHITE CLOVER

Under conditions of grazing, the ultimate influence of either white clover or added nitrogenous fertilizer is magnified by returns of nitrogen to the sward in the dung and urine of the grazing animal, as shown by Sears [1] and Watkin [2], when several fertility cycles may occur in one grazing season. It is reasonable to assume that these cycles, from sward to the grazing animal and back to the sward, are greatly accelerated by mixed stocking, which obviates the fouled patch. This rejected herbage must be regarded as a site of locked-up nitrogen. Furthermore, grazing prevents the crowding out of white clover which results from unchecked growth of grasses following applications of nitrogenous fertilizers.

Under conditions where the herbage is cut and carted off the field, the picture is very different. Here, considerable quantities of nitrogen are removed from the field and further growth of herbage depends, amongst other things, on fresh supplies of available nitrogen—further applications of nitrogenous fertilizer, or further contributions from the white clover nodules if white clover can be induced to persist under these conditions.

To ascertain the contribution of white clover in an ungrazed sward, and at the same time to gather information on ancillary issues of the interaction of white clover and nitrogenous fertilizers, a trial was laid down at Sutton Bonington in 1951. The results of this trial are mainly in accordance with published findings, but are of interest in generally supporting the conclusions recently reached by Walker *et al.* [3, 4, 5, 6].

Eighteen treatments, comprising interactions of S.24 perennial ryegrass and S.37 cocksfoot with S.100 and wild white clover at three levels of nitrogenous fertilizer application, were each replicated eight times. Single applications of fertilizer were given each year, and during the first year the plots were grazed to allow the successful establishment of the white clovers. Analysis of soil samples taken prior to the application of fertilizer showed no appreciable difference in total content of soil nitrogen.

The results reported here refer to the 1953 season, when three silage cuts were taken. It is appreciated that this treatment is contrary to normal farming practice, but the principal object of the trial was to estimate the inter-relationship of white clover and nitrogenous fertilizer in the absence of the grazing animal. The data relating to the first cut of herbage may be regarded as indicative of the happenings in any sward cut for conservation.

Even before cutting the first time, changes in the composition of the sward were apparent following the application of "Nitro-Chalk" at the rate of nil, 2 cwt. per acre and 10 cwt. per acre. The major change was a reduction in the proportion of white clover, this reduction being much greater where the companion grass was cocksfoot rather than perennial ryegrass, and much greater at the higher levels of "Nitro-Chalk" application with both grasses.

Wild white clover was suppressed to a significantly greater extent than S.100 white clover, a result which may be attributed to differences in growth form of the two strains.

Yields of Dry Matter As might be anticipated, nitrogenous top dressings gave increased yields of dry matter, although the increases were by no means proportional to the quantities of nitrogen applied. Although in the majority of cases where nitrogenous fertilizer was applied an increase in yield due to the presence of white clover was apparent, in no case could these increases be regarded as significant. In fact, the contribution from white clover without fertilizer nitrogen *under these conditions* over the season in no way approached the increased yields from

a single application of 2 cwt. "Nitro-Chalk" per acre. A further point of importance is that a single heavy application of fertilizer showed an effect over all three subsequent cuts, whereas the effect of an application of 2 cwt. per acre was virtually lost after the first cut. The yields of dry matter from the second and third cuts of this treatment were generally lower than those from plots which had received no fertilizer in the first instance, thus supporting the contention that when herbage is cut and removed from a field, further growth depends upon fresh supplies of available nitrogen. In this case the white clover had been sufficiently suppressed to make little material contribution. In the high-nitrogen plots there was sufficient residual nitrogen to show an effect in the second and third cuts, despite a rainfall of 4.67 inches in the interval between applying fertilizer and the first cutting.

White clover of both strains made the greatest contribution in company with perennial ryegrass rather than with cocksfoot, while cocksfoot, particularly with nitrogenous top dressing, outyielded ryegrass in terms of yields of dry matter. This latter point is not put forward as evidence of the superiority of cocksfoot over perennial ryegrass, for animal production from grassland is not entirely related to total yields of dry matter, and on other occasions, when the relative output of these two species has been measured in terms of utilized starch equivalent, ryegrass has proved superior, although giving lower yields of dry matter (7).

In each case, added nitrogenous fertilizer resulted in a reduced percentage of dry matter in the herbage. This effect was most apparent with the first cut of herbage, where untreated averaged 20.0 per cent DM., that which received 2 cwt. "Nitro-Chalk" averaged 18.1 per cent D.M., and that which received 10 cwt. "Nitro-Chalk" averaged 16.3 per cent D.M. The presence of clover did not materially affect the dry matter percentage.

Composition of the Dry Matter Apart from revealing the increase in crude protein content of the dry matter following the application of nitrogenous fertilizers (an effect which has been demonstrated on very many occasions), these results showed an increase in crude protein due to the presence of white clover. This increase was masked only at the higher level of fertilizer application, and in other cases ranged between 2 and 4.5 per cent increase—the higher figures resulting in the absence of fertilizer nitrogen. In this respect, S.100 white clover almost invariably gave higher contents of crude protein than wild white clover, due no doubt to the better ability of the former to withstand the conditions of this trial. This observation in no way detracts from the value of wild white clover under grazing conditions, but merely commends the use of the more vigorous white clovers in leys intended primarily for conservation.

In every case the presence of white clover resulted in an increased content of CaO in the dry matter, the increase being directly related to the increase in the proportion of clover. "Nitro-Chalk" in itself had no direct influence on the CaO content in the pure grass swards, but through the suppression of clover in the mixed swards it indirectly resulted in a reduced CaO content. This effect was especially great in the plots which received the higher nitrogen dressings. Without clover, the CaO content of the herbage was remarkably constant for both grasses at all levels of fertilizer application.

The presence or absence of clover had little influence on the content of P_2O_5 in the herbage, whereas "Nitro-Chalk" applications significantly reduced the P_2O_5 content. The total weight of P_2O_5 varied only slightly from

plot to plot, irrespective of treatment, but with higher yields of dry matter, particularly from the heavier fertilizer applications, the percentage of P_2O_5 was reduced.

These interactions considerably altered the ratio of CaO to P_2O_5, which aspect has been regarded as of great consequence in herbage for the dairy cow in particular ([8]). Both the presence of white clover (through its effect of increasing the CaO content) and the use of nitrogenous fertilizers (through their effect in leading to a reduction in the P_2O_5 content) resulted in an increase in the $CaO:P_2O_5$ ratio. The fertilizer applications had by far the greater effect in this respect, and at the 10 cwt. "Nitro-Chalk" level the ratio was as high as 2.15 to 1.

Discussion and Summary The results of this trial confirm the effects of clover and nitrogenous fertilizer on the quantities and quality of the herbage produced for conservation, as distinct from their effects on a sward which is grazed. Under these conditions, white clover is materially productive only in the absence of nitrogenous fertilizers, and even then the contribution from white clover is not so great as the increase obtained from an application of 2 cwt. "Nitro-Chalk" per acre. Against this, the single moderate applications of fertilizer resulted in reduced yields of herbage in the second and third cuts, due to the suppression of white clover. Heavy dressings of fertilizer nitrogen (10 cwt. "Nitro-Chalk" per acre) resulted in a considerable increase in the yields of herbage and of dry matter, but at the same time the effects of such dressings on the quality of the herbage must be considered.

If crude protein content can be regarded as the true criterion of herbage quality, then quality was improved; but if the $CaO:P_2O_5$ ratio is of significance, then the reverse is true. Furthermore, the reduction in dry matter resulting from heavy fertilizer applications is of great consequence, particularly where hay has to be made under adverse weather conditions.

These results add support to the suggestion made by Watkin ([2]) who, doubting the advisability of applying small quantities of nitrogenous fertilizers to the whole of the grassland on a particular farm, tentatively recommends the application of heavier quantities of fertilizer to the less clovery proportion of the grassland and no fertilizer nitrogen to the very clovery fields, unless it is desired to reduce their clover content purposely. This argument would seem to apply in the case of grazed or cut swards alike.

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THE CATTLE OF BRITAIN

21. HIGHLAND

THE first Herd Book of the Highland Cattle Society of Scotland was published as a retrospective volume in 1885 and contained the registrations of bulls calved before January 1, 1884. In a historical note in the Preface to this volume it is stated: "Whether there ever was an aboriginal breed in this country is a question which has been much discussed, and upon which a variety of opinions is held, but it is one which is still in a great state of uncertainty." That same uncertainty continues today. One thing, however, is certain. That is that no cattle in this country have maintained in greater uniformity the same characteristics as a distinct breed than the Highlanders have done, and this seems to point to the conclusion that there has been little change in the character of this class of cattle, except that produced by a more careful system of breeding.

On the question of colour, the Herd Book description continues: "The normal colour of the Kyloe (or West Highlander) was black, and in the recollection of some who are still alive no other colour was known in the leading folds of the West. The pure Kyloe also seems to have been smaller and shaggier than the Highlander (or Mainland Highlander), but whether this was a distinctive feature of this class of the breed, or whether it arose from the cattle being kept in a purer state and more exposed to the elements than the mainland cattle, it is not easy to say." Earlier writers constantly refer to the "black cattle" or "Crodh Dubh", but it should be remembered that this was a term of considerable elasticity in meaning. The phrase was in some cases used to distinguish cattle from horses, and it was also used principally because the cattle of the day were mostly dark in colour. There were varying degrees of red, brown and brindle, and while "black" may have been the popular colour at one time, it is not so today. The first black bulls to be seen at Oban February Sales for many years were there only last year. In any case, there is a tradition in Glenlyon of a race of white cattle flourishing before 1700; and the Jura fold was of unknown antiquity in 1764.

However, even though the origin of the Old Breed is obscure, it is a known fact that at one time Highlanders supported a cattle industry which formed the main source of wealth in those areas. It is this fact that brings us right up to date in our survey of the Highland breed, for upon it are based most of the present-day arguments in favour of more cattle coming off the hills.

It is not, of course, the purpose of this article to examine whether or not the Highlands—or the hill and marginal farms anywhere—can be made to carry the vast numbers of cattle visualized by some enthusiasts. But that the hills could carry more cattle is certain, for at the time of the Union of the Crowns in 1603, Highland farming ceased to be subsistence farming and became commercial, with the result that a great trade in store cattle to the lowlands and to England developed. What was done then could conceivably be done again, even though present-day methods by no means resemble the old. The salient fact is that if more beef is to come off the hills it will come not from cattle of useless constitution and nondescript breeding, but from a hill breed that has the capacity to thrive under rigorous conditions. The Highlander is a hill breed without rival, and it is also a beef breed. It is little wonder that in recent years interest in the possibility of hill country as a source of beef has focused new and still-growing interest on the Old Breed.

One of the factors operating against the rapid extension of the Highland breed is the difficulty met with in disposing of male calves not wanted as bulls. It is said they are slow to fatten, although they are not as slow as some folk would have us believe. Highland heifers, on the other hand, are easily and profitably sold. The reasons are that the Highland cow can live well in hard country and under rigorous conditions. Her hardiness and longevity are universally acknowledged, and she can at the same time raise a cross calf, preferably by a Beef Shorthorn, that is relatively easily fed and readily sold.

This brings us to one of the factors operating in favour of the Highlander (and incidentally of the Beef Shorthorn) in relationship to the drive for increased numbers of hill cattle. The Highland cow will cross more or less successfully with other breeds, but there is no doubt that the most successful results are obtained by crossing with the Scotch Beef Shorthorn. The advantages of this were first recognized many years ago. Thomas Bates, of Shorthorn fame, in his earlier years experimented with the Shorthorn crossed with the Kyloe. Undoubtedly the popularity of this cross is growing and will grow. Dr. Alan Fraser in *Beef Cattle Husbandry* states that about 1908 all the cattle coming from Western Ross-shire were of this type. "The cross with the Aberdeen-Angus and the fashion for the black polled calf came later, and was not altogether favourable for the Highland breed."

There has been influential backing for the Highland cow and her Shorthorn-cross calf from the more successful experimenters in the reintroduction of cattle on to the hills. Mr. D. M. Stewart of Millhills, leading figure in the Ben Challum venture, makes no bones about the value of this cross as foundation stock, and Mr. J. A. Cameron of Glenfinlas, who has wide experience of hill farming and hill cattle, is just as positive. The prospect for the Highlander at home is therefore becoming increasingly rosy, and it will undoubtedly be brighter as the drive to put more cattle on the hills becomes more widespread and successful. Indeed, it is not too much to claim that ultimate success in these ventures will depend greatly upon what use is made of the Highland cow and her Shorthorn crosses.

The Highland Cattle Society, founded in 1884 to maintain the purity of the breed, has now closed the Herd Book and has instituted a drive, which shows signs of definite results, to bring about an increase in pedigree registrations. An effort has also been made to stimulate the export trade. That is still distinctly limited, but it is growing, and last October twenty pedigree Highland bulls left Glasgow in one shipment for Montana and Dakota. A single bull has gone to the Argentine, and there are also small but regular shipments to Peru. The Highlander is nowadays to be found in places far removed from its native glens and hills—in Newfoundland, Queensland, South Africa, Russia and Czechoslovakia.

A recent writer has said: "It has often been claimed with commendable frankness that the Highlander is the most picturesque of breeds". That is no more than the truth: but it is an understatement of the Highlander's worth. The Highland breed has made, and will make again, a valuable contribution to the livestock economy of this country.

D. G. Noble,
Secretary,
The Highland Cattle Society of Scotland

FARMING AFFAIRS

Protecting Bacon in Transit The manufacture of plastic and other materials in the form of transparent film, coincident with the increasing attention being paid to the more hygienic handling of foods, has resulted in important and interesting developments in the use of wrappings having attractive, as well as protective, qualities. On the one hand, there has been the use of films of cellulose-acetate, cellulose-viscose, rubber-hydrochloride, and polythene for the effective presentation of fruit and vegetables in consumer-packs for retail sale. On the other, there is the less widespread improvement in the methods of protecting bulkier foods in transit.

A notable example of progress in the last-mentioned was provided at Doncaster in December, when a well-known Yorkshire firm of provision wholesalers demonstrated the new method of wrapping sides of bacon, gammon, and hams, which they have introduced. The material used is polythene, a tough, transparent film (made by subjecting ethylene gas to high temperature and pressure in the presence of a catalyst) which was discovered in 1932. This film is very strong, flexible, moisture-proof, non-tainting, non-contaminating, and its properties remain unimpaired down to a temperature as low as −60°C.

Polythene is also completely waterproof, greaseproof, resistant to bacteria and fungi, non-corrosive to metal, and has a low moisture-vapour transmission rate. It presents no problems in regard to the control of humidity or temperature when used for the wrapping of foods that have to go into cold storage. The fact that it will stand up to and not become brittle after storage in sub-zero temperature is one of the reasons it has been used so successfully for several years for the wrappings of quick-frozen poultry.

At Doncaster, sides of bacon were shown being encased in seamless tubes of polythene film drawn from coils on which the tubing is rolled in lay-flat form. As soon as a side was completely encased the tube was tied at the top; the appropriate length of tube was then cut off and the covering tied at the bottom. Ordinary string or rubber bands can be used for this purpose.

The process of film-wrapping takes no longer than the covering of a side of bacon with cotton net, and, judging by the six months' experience of these users, the slightly increased cost of polythene is justified by the greater protection which it affords. No part of the meat thus wrapped is exposed, and any dirt with which the outer surface of the film comes into contact remains outside. Another advantage of polythene—also supplied in sheet form, in cut lengths of lay-flat tubing, and in ready-made-up bags (the tubes heat-sealed at one end)—is that it can be treated to provide a surface suitable for printing. The packer's name and brand are thus quickly identified.

The price of polythene is rather more than twice that of cotton net, but as it prevents loss of weight and deterioration during transit, and keeps the bacon in better condition in all respects, the Doncaster packers have, after six months use, decided that it is an economic proposition.

Edward Hammond

Farming Cameo: 49. Newark, Notts The Newark district comprises 77 parishes in the east of Nottinghamshire and includes approximately 106,000 acres of agricultural land. It is an area of mixed farming with the emphasis on arable crops and milk production—some 69,000 acres being under arable cultivation and leys. To the north, south, and west

it adjoins the other Nottinghamshire districts, while to the east it extends to the Lincolnshire boundary. The district centres on the town of Newark-on-Trent, from which all the principal roads radiate. Topographically, the area is gently undulating to flat. The highest point (300 feet above sea level) is reached at the historic Mill Field, Laxton, where are to be seen the last few hundred acres of land in England still cultivated under the ancient "3-field" system. The outstanding physical feature is the Trent Valley, which bisects the area from north to south—a wide, shallow vale dividing the red-clays and marls of the Keuper from the light sands and gravels to the east.

The Keuper Marl region is, in general, given over to milk production, with wheat as the main arable crop. The soil being naturally deficient in phosphorus, both arable crops and grass demand generous treatment with phosphatic fertilizers. Waterlogging is a feature of many fields and attention to drainage is essential before successful crops can be grown consistently.

The higher levels of the Trent Valley are devoted to arable cash crops, with some productive dairy farming. A large proportion of the district's 4,000 acres of sugar beet is grown here within easy reach of the Kelham Factory of the British Sugar Corporation. The soils vary from excellent free-working loams capable of growing a wide range of crops, to coarse gravels which are very short of lime and potash and suffer severely from drought. On these soils, cocksfoot with lucerne or white clover has shown great promise as a forage crop. The Trent flood-plain is largely under permanent grass. A few farmers have by good management produced excellent river-side grazing, but most of this grass is of indifferent quality, although the soils are generally deep and potentially productive. The very old turf can present difficult problems in ploughing and cultivation, but those farmers who have tackled the job have been rewarded with some very good and profitable crops.

East of the Trent the land is light in character, varying from poor sandy gravels with areas of valueless blown sand in the north, to the better sands further south on which the Collingham carrot-growing industry started. These soils need regular liming, and the provision of adequate potash is of great importance. Arable farming, allied to the rearing and finishing of Lincoln Red cattle, is the general picture in this region, although there are a few very well-managed dairy herds fed on leys, lucerne and silage. Cocksfoot leys have again proved valuable and should be a means here of improving the fertility of the land, which is in great need of organic matter. South of Newark the soils are more varied and provide most of the best land in the district. A wide range of arable crops are grown, including a substantial area of grasses and clovers for seed. In the extreme south-east there are some very heavy soils on Lias Clay, with a high proportion of the land under grass. The economy of most of the farms pivots on livestock. The arable land can grow only a restricted range of crops but, given skilful management, will produce good yields of corn and the usual heavy land crops. Combine drilling of phosphates is of especial value to counteract the extreme deficiency of phosphate.

The traditional breed of cattle in the area is the Lincoln Red Shorthorn, and it still predominates among the beef breeds. The British Friesian is the most numerous dairy breed, although the recent emphasis on attestation has seen the Ayrshire herds gain in popularity. Pigs and poultry contribute increasingly to the income of a large number of the holdings, but the sheep population does not increase in the face of the difficulties of shepherding and the ever-present menace from stray dogs.

The past fifteen years have seen a great change in the attitude of the majority of the farmers of the district to the ploughing of grass. The "gospel" of ley farming is widely accepted and its practice is, for the most part, restricted only by consideration of capital and the need to expand livestock numbers.

D. W. Garrard,
District Advisory Officer

The Mechanic on the Farm: 10. Measurement in the Workshop

Many repair and construction jobs can be managed perfectly well without any measurements being made. Nevertheless, a few measurements usually save time rather than waste it, because cutting and drilling by guesswork so often has to be corrected later. For metal work, a simple steel rule marked in inches, or inches and centimetres, is sufficient. Folding rules which shut down to six inches or less can be bought, but it will be found that a single scale is easier to read accurately on a flat surface, because its whole length is in contact with the surface. Even with a thin, single-section steel rule, it is possible to make an error in measurement unless the eye is exactly over the division line which is being read. The thicker the rule the more serious the error can become. Flexible steel tape measures which roll up into a pocket case are convenient for many purposes, but they cannot be used for marking out. The engineer's steel single-section rule is rigid enough to be used as a straight edge for scribing lines on metal surfaces which are to be worked upon, and to provide a bearing surface for a knife when cutting soft material.

For marking out metal, a round scriber is normally used. This is a steel rod knurled to provide a good grip for the hand and tapered to a point at one end so that it will scratch metal. If the scriber is thin and its point is a very gradual taper, it is possible to draw a line fairly near to the guiding edge of the rule, provided the scriber is held so that it tends to undercut the rule. If the scriber is held upright, there will be a space between the rule and the point of the scriber. A scriber can be used for marking wood as well as metal, but it is better to use a pencil. It is worth while buying a carpenter's oval pencil, since it is possible with this type of pencil to bring the lead nearer to the edge of the rule than can be done with the ordinary round one.

A steel try-square should be part of the equipment of the workshop. It consists of a thin rectangular blade fixed exactly at right-angles into a rectangular length of thicker steel. The edges of each arm are parallel, and so the try-square can be used for the inside or outside of angles equally well. Centre punches, such as are used for starting a drill position, will also prove useful to mark the boundaries of scribed patterns. For example, a piece of metal may be centre-punched at the point of intersection of two straight lines. For this work, both centre punches and scribers have to be kept sharp.

If much accurate work has to be done, it will be found that a level surface plate is needed as the datum for making measurements and marking out work to be cut or drilled. Another use for the surface plate is for finding the high spots on metal which is being filed or otherwise made flat. To do this, a thin film of red lead and oil is spread on the surface plate and the object being examined rubbed in contact with it. The dabs of colour transferred to the object will show where the high spots are. A surface plate is made of cast iron, and is planed and carefully scraped until it is dead flat. The fine surface must be preserved, and therefore the plate

must never be used roughly or hammered upon. For some purposes, a piece of plate glass will serve in place of a surface plate.

The accuracy required in woodwork is generally less than that needed for work in metal, and wooden folding rules are perfectly satisfactory for making measurements. Although they are thick, their hinges are contrived so that all the sections lie flat when the rule is opened. A steel rule is useful for testing planed wood for flatness.

The possession of a sliding gauge for marking lines parallel to an edge of wood will save much actual measuring when work is being set out. The usual kind consists of a wooden bar with a sliding block of the same material and a fixed pointed steel pin. This particular design is, however, intended only for marking lines in the same general direction as the grain, or along end grain. For marking across the grain, the type having a knife blade instead of a pointer must be used.

H. J. Hine

Investigation into the Production and Marketing of Maincrop Carrots The production methods for maincrop carrots in England are generally satisfactory, according to a report of a large-scale investigation the Ministry of Agriculture and Food carried out on farms and in wholesale markets during the 1953-54 season. But there appears to be room for improvement in marketing. The quality of as much as four-fifths of the consignments examined could, say the investigators, have been improved by more careful grading to eliminate substandard roots, and attention might have been given to size-grading to exclude very small and very large carrots. As a result of favourable weather, 1953-54 was a very good carrot year. Markets were fully supplied for most of the season and prices were fairly low.

During the period of the survey limited supplies of good quality and evenly-sized Dutch carrots, packed in non-returnable bags, arrived on home markets. Most consignments were imported in March and April, when good quality home produce was scarce, and so they attracted higher and more consistent prices than the bulk of home-grown supplies. The latter were by then generally of a poorer quality, less closely graded for size, and were packed in returnable bags.

The report points the lesson that better grading and presentation are essential if the home-grown crop is to compete successfully with the Dutch maincrop carrots.

A limited number of copies of the report are available free on request from the Ministry of Agriculture and Fisheries (Horticulture Division), Whitehall Place, London, S.W.1.

M. de Wachenfelt leaves the U.K. It is with regret that we have to say good-bye to Monsieur M. W. F. de Wachenfelt, C.B.E., who has been Agricultural Counsellor to the Royal Swedish Embassy in Britain since 1921. During his 33 years of indefatigable service in the U.K., M. de Wachenfelt has made many firm and enduring friendships throughout the agricultural industry, and, by his kindly and willing co-operation at all times, he has done much to foster Anglo-Swedish relationships to a very high level. Our good wishes go with him on his return to Sweden.

At the same time we extend a very cordial welcome to his successor, Monsieur Uno Enegren, and wish him every success in his new and important post.

Fertilizers and the Profitability of Farming Much more fertilizer could be used in this country, with profit to the individual farmer. This point clearly emerged from the Discussion Meeting held in London on January 19 by the Fertilisers Manufacturers' Association and the Superphosphates Manufacturers' Association. Mr. G. D. Bailey, farming near Loughborough, Leics, Mr. Christopher Hunt, Farm Manager to Mr. J. Goring who is farming on the Sussex downs, Professor H. G. Sanders, newly-appointed Chief Scientific and Agricultural Adviser to the Ministry of Agriculture, Mr. H. Rope, Director of a fertilizer company, and Mr. C. Bosanquet, Rector of King's College, Newcastle (in the chair), comprised the panel.

True, the rate of fertilizer usage in the U.K. shows an encouraging increase, but the total consumption is relatively low compared with that in such countries as Denmark, Belgium and the Netherlands, where the farms, like ours, are small. In the panel's view, it is the small farmer, rather than the large, who could very profitably use more. The sensible use of fertilizer, whether nitrogen, phosphate, or potash, is fundamental to greater productiveness; and the question is not—fertilizer *or* muck?, but rather the complementary use of both in relation to cropping and soil type. Soil analysis is a useful guide to fertilizer treatments, and every crop should have individual manurial consideration; many farmers have a quite wrong impression about the immediate availability of residual values.

Professor Sanders drew attention to the new varieties of cereals with shorter, stronger straw, which are capable of standing up to dressings of 3-4 (in some cases even up to 6) cwt. per acre of nitrogen, as compared with the modest 2 cwt. per acre which was formerly customary practice. But it is on our grassland where the greatest increase in use could be made of fertilizers to promote productivity—in grazing and conservation. If every increment so gained is utilized to the full, profitability will look after itself.

BOOK REVIEWS

Forage Farming. J. R. Stubbs. Dairy Farmer (Books) Ltd. 15*s*.

Livestock products, and particularly milk, can be produced most cheaply from our own acres if we use those acres principally for the production of forage crops. That is the author's thesis and obviously his belief. The two forage crops that J. R. Stubbs exploits to the full are grass and kale—both producers of large quantities of cheap food per acre. And "exploits" is surely the right word, for the grass in *Forage Farming* is not the result of a policy of falling back by way of long leys to permanent grass. Far from it; a five-year rotation has six crops, including two periods in grass!

Though willing to encourage the fullest use of the relatively cheap tractor power available to most farmers for the cultivation and growing of these forage crops, the author does not expect a farmer or his men to become beasts of burden in transporting these heavy water-containing crops to his stock. Forage farming, in his own words, "harnesses the animal to do its own harvesting for as near 365 days of the year as possible". Equally, he expects the cattle to do their own dung-carting.

Milk production on forage farming systems is naturally given most attention in this book, and there are many practical hints on management, including some warnings of difficulties that have been experienced. However, the chapters on the application of forage farming to store cattle, beef, mutton, lamb, and pigs—even if based on fewer practical examples than the milk story—are certainly thought-provoking.

The research worker will look in vain for details of replicated plots and control groups, for this is purely a collection of the farming experiences of a keen and enthusiastic observer which have convinced him of the soundness of the system which

he expounds. The many young-minded farmers who will certainly be reading this book will find there all the excuses they need for breaking with tradition, and few will fail to be stimulated. Like the Italian ryegrass mentioned in Appendix 1, J. R. Stubbs earns four stars for the " excellent, stimulating properties " of his book.

S.L.H.

Agriculture: A New Approach. P. H. HAINSWORTH. Faber. 21*s.*

In the 1920s we were suddenly astonished to find that grass, the commonest and most important crop in Britain, was the crop we knew least about. Now it has just begun to dawn on us that we know even less about something even more common and even more important—the soil itself. We have begun to inquire, but we find that the relationship between soil and plant is so complex that it is extremely doubtful if anyone can say with certainty exactly how a plant draws its nutritional requirements from the soil and assimilates them to its living body.

Mr. P. H. Hainsworth has tried to bring together all the relevant material from the increasing number of farms that work on " organic " lines, explaining the results in scientific terms, and to suggest possible explanations where the answers are not obvious —as, for example, when soil analyses show more nitrogen present in soil where none has been applied in chemical form than where heavy dressings of the fertilizer have been added. It is a trifle difficult, as a layman, to be quite sure at times when Mr. Hainsworth is putting forward an accepted scientific fact and when he is merely propounding a possible theory of his own to explain a given phenomenon. But the more one thinks about this, the less it seems to matter; for knowledge on this subject is so deficient that most theories connected with it must lie largely in the realms of surmise. The great merit of the book is its power to stimulate thought in minds that are not already bolted and barred against all orthodox teaching on the one hand, or against the " muck and mystery " boys on the other. Faith is a necessity to the human race, and a man is a poor sort of creature without it; but while it inspires the genuine seeker after truth, it must not be allowed to colour his findings, whether he seeks to defend the orthodox or to breach its walls in revolutionary ardour.

A particularly interesting chapter is one that suggests the mechanics of growing the crops, assuming that the health and activity of micro-organisms in the soil is all-important. It shows how very much adrift experiments can become simply by faulty designing. The soil, in fact, is so complex in relation to plant nutrition, with so many variables, that to design an experiment to exclude all the variables, except the one to be tested, seems to present difficulties that may never yet have been surmounted. Over and over again the author is driven back to quoting the empirical results obtained at Haughley Research Farms, simply because no other comparable experiment with the soil exists in this or in any other country. Yet research at Haughley has hitherto been made possible entirely by private money and has several times in its ten years of life been in danger of extinction from lack of funds. It must surely be to the credit of the Ministry of Agriculture that in Haughley's darkest days of unpopularity and impecuniousness they recognized it as a genuine experiment and gave it moral support. Now it is paying dividends in new knowledge that other countries besides our own are seeking.

But this book is not only for scientists. It contains a stimulating chapter on practical farming based on shallow cultivations with liberal use of rotary cultivators and disc harrows, controlling weeds by their destruction rather than by ploughing them in, with the danger of bringing them to the surface to seed again just before the crop is sown. Various examples of rotations to fit these methods are given.

There is nothing polemical about this work, challenging though it may be. There can be no one who knows so much already that he could not profit by reading it.

L.E.

Handbook of Organic Fertilisers. Fertiliser Journal. 6*s.*

There has long been a need for a treatise on organic fertilizers giving plain statements of fact devoid of the embellishments of mysticism. The Association of British Organic Fertilisers is to be congratulated on presenting such a volume. The book is in three main sections: an introductory section dealing with the soil, followed by one giving the various types of fertilizer available, and a final one on their use.

In dealing with the types of fertilizer, the raw materials which go into the final product are briefly and adequately described, as also are the methods of manufacture. The average composition of most of the fertilizers is given, with an occasional reference to the upper limits. It is regrettable that the lower limits of some of the products are not stated in order to illustrate that worthless material can occasionally appear under the guise of an organic fertilizer.

Although fundamental experimental information on the use of organic fertilizers is

sparse, the available evidence has been condensed and presented in a commendable manner. Naturally, the tendency has been to restrict manurial recommendations to horticultural crops, frequently in general terms but occasionally with specific recommendations. In all instances maximum production is the aim, so the use of judicious mixtures of organic and mineral fertilizers is proposed.

On the whole, this is an excellent production which can be recommended to fruit and vegetable growers, students, and advisers on fertilizer problems. *J.W.B.*

World Population and World Food Supplies. SIR JOHN RUSSELL. Allen and Unwin. 50*s*.

In Sir John Russell's library in his home near Oxford there is a row of bound volumes containing his notes of many journeys all over the world. For half a century he has travelled in search of agricultural wisdom. He has questioned farmers, addressed Rotary Clubs, met statesmen and scientists, and read whole libraries of reports and technical papers. In a way reminiscent of Darwin's own thinking, every fact and idea which enters Sir John Russell's mind becomes integrated into a coherent view of his subject. It is a rare quality of mind, none the less remarkable through being less ostentatious than brilliance and less disturbing than creative genius.

World Population and World Food Supplies is the harvest of Sir John Russell's whole long and distinguished career. Without his early years of research, his three decades of administration, his journeys, and his accurately preserved records, he could not have written the book; and there is no one else in the English-speaking world qualified to write it. The book surveys the statistics of agricultural production in the world, region by region. It discusses with rare insight the problems of farming—scientific, economic, and social—in countries as diverse as Scandinavia, the Belgian Congo, and China. It presents data on land utilization in Ireland, India, and among the Kikuyu. The book begins with a short chapter on population trends and ends with an equally brief chapter on trends in world food supplies.

The reader who revels in dramatic jeremiads about approaching world starvation will be disappointed, for Sir John Russell pins his faith (and with good reason) on the possibilities of greater productivity. The average yield of potatoes in Britain, he says, is about 8 tons per acre, but a good grower expects 10-12 tons, and the record is 27 tons. The greatest single factor in high productivity is not science, nor economics, but simply good husbandry.

The book is written clearly and is admirably illustrated by graphs, diagrams and photographs. If there is one criticism, it is that the index is inadequate for such a monumental volume, and in some places the index references are inaccurate. But these are trivial matters beside the merits of the book. For once the publishers' claim is correct: Sir John Russell's book " will remain unique in its generation ".

E.A.

Squirrels. MONICA SHORTEN. Collins. 15*s*.

The steady spread of the North American grey squirrel, which was introduced about 1880 at the expense of the native red squirrel, has been the most noteworthy and unwelcome change in our wild fauna during recent times. Unwelcome because, while the red squirrel did occasionally become so numerous that it damaged plantations of conifers, it is on the whole a harmless and, indeed, attractive little beast; whereas the grey squirrel can do very serious harm to fine young stands of sycamore, ash, and even oak, by ring-barking their stems, and is not averse to raiding orchards for fruit, or cornfields for grain. Hence the need for the squirrel clubs, and the Forestry Commission's " bob-a-tail " bounty, which appear to be gradually effecting some degree of control over the numbers of this alient rodent.

Miss Shorten's approach is that of the biologist, who seeks to record all available scientific facts about an animal before considering ways and means of reducing its numbers. She tells us all about the ways in which both red and grey squirrels feed and breed, both here in Britain and in other countries where they are native. She discusses the relationships between the two species, the damage they do, methods of shooting and trapping them, the remarkable fluctuations in their numbers that occur from time to time, and the way in which the invading greys have steadily spread from their known centres of introduction. There is even a recipe for squirrel pie!

Combining a lively literary style with much learning, Miss Shorten presents the results of ten years' research in a very readable fashion, and her volume is beautifully illustrated. There has long been a need for such thorough accounts of individual British mammals, and the squirrel tribe have been fortunate in their chronicler. The reader is left with the feeling that there is still much to be learned about the lives of even these common and conspicuous rodents, which merit attention as subjects of scientific study as well as pests of forest and orchard. *H.L.E.*

Developing Farm Woodlands. J. F. PRESTON. McGraw-Hill. 36*s*.

Although this book has been written for farmers in the United States, it would, in Britain, be described as a text-book on estate forestry. It follows in its layout the usual plan for books on this subject, with chapters on planting, thinning, marketing, and so on, but a study of its contents reveals some aspects of forestry practice which are not usually found in this country.

The underlying theme which runs through the book is that, with proper management, the farmer's woods can produce a useful income, in the same way as the rest of his land. Although the subject is covered with considerable thoroughness, one cannot help feeling that in this country a much smaller, concise book would be more acceptable to farmers interested in the management of trees on their farms. Soil erosion is a very real problem in certain parts of the United States, but soil stabilization and the provision of shelter-belts receive rather less attention than might be expected.

Certain species of trees, particularly black jack oak, are considered undesirable in the U.S.A., and the use of chemicals to destroy these and unwanted stool shoots is apparently widely adopted there. The two poisons which have been found most satisfactory are sodium arsenite and ammonium sulphamate, the latter being preferable because it is neither poisonous to man nor animals. The object is to kill poor quality hardwoods, and so encourage the growth of more desirable species by giving them more light and growing space. In an attempt to produce correctly thinned stands, a thinning formula is also given, and to encourage the actual marking of the trees to be thinned, the use of a pressure paint gun is advocated.

On the subject of timber preservation, several alternatives to creosote are suggested, including zinc chloride, sodium fluoride and sodium carbonate. Under one system the butts of freshly felled poles are placed in tubs of these salts. The branches and leaves are not removed, so that the preservative is slowly drawn up and absorbed throughout the length of the pole. A whole chapter of the book is devoted to the growing and marketing of Christmas trees, and it would seem that this has become far more selective and specialized in America than it is in Britain. This chapter should be of particular interest to growers in this country.

The book is well printed, with a large number of photographs and some excellent line drawings. At the end of the book there are no less than ten appendices, which include a bibliography, yield tables, an example of a timber sale contract, and a list of "visual aids" dealing with forestry.

N.D.G.J.

National Institute for Research in Dairying (1953 Report). 3*s*.

The work of the N.I.R.D. continues to grow in scope and extent year by year, as a perusal of the latest annual report clearly shows. Within the compass of 120 pages has been summarized the activities of the eight research departments in the Institute, as well as of the recently established Isotope Section, the Experimental Dairy, the Statistics Section, the Stenhouse Williams Memorial Library, and the Commonwealth Bureau of Dairy Science, which is closely associated with the Institute.

Although the Institute is organized in departments, much of its work necessitates close collaboration between a number of departments or sections. During the year under review valuable work has been done on many subjects, including milking machine rate; secretion rate; dry period infections of the udder; calf rearing and antibiotics; antibiotics in the diet of fattening pigs; mechanical treatment of crops for silage; level of roughage and fat content of milk; accuracy of lactation milk records; the synthesis of fat by the mammary gland; citric acid in milk; penicillin in milk; classification of lacto-bacilli; penicillin-resistant organisms and mastitis; infectivity of mastitis-producing organisms; phosphatase test; bull semen; off-flavour in cheese; pregnancy diagnosis in the cow; keeping quality of butter; sterilized milk; and immersion cleaning of milking equipment.

The research work carried out and in progress in the various departments is, however, so varied in character that it is impossible even in the report itself, let alone within the space of this short review, adequately to indicate the full significance and importance of the N.I.R.D. to all sections of the dairy industry. Nevertheless, the above selection of some of the subjects being dealt with will serve to show how valuable the Report is to all those who are in any way connected with dairying, whether in production on the farm or distribution to the consumer.

Copies of the Report are obtainable from the National Institute for Research in Dairying, Shinfield, Berkshire.

S.S.

Tomato Growing. F. W. ALLERTON. Faber. 18*s.*

The production of a comprehensive book on all aspects of tomato growing in Great Britain places upon the author the onus of serving two distinct masters—the glasshouse and the outdoor grower. This, Mr. Allerton has attempted to do, although because of the much greater importance of the glasshouse crop in this country, he has given over most of his new book to glasshouse culture. Outdoor tomatoes are dealt with in ten or so pages at the end.

The opening chapter strikes an essentially practical note, which is well maintained throughout the book, by stressing the importance of hygiene in the glasshouse and the measures necessary to lay the foundation of a healthy crop. It then develops with some sound advice on propagation, border preparation and planting systems, gives a good deal of space to feeding (with, perhaps, too much emphasis on historical details), has a little to say on composts, and finally deals very sensibly with the subject of pests and diseases.

The author does not always avoid the pitfall of giving descriptions of *all* possible methods, rather than advocating one or limiting the choice of alternatives. It is also unfortunate that there are so many references to the virtues of certain proprietary materials, and there are some surprising omissions in the text. Thus the author assumes that "everyone knows the details of John Innes composts"—an assumption which is far from justified. Similarly, the subjects of grading, packing and marketing are left untouched, while the only mention of supporting the plants in the house is a brief reference to stringing contained in the section on hygiene.

The book has some excellent illustrations but, with one exception, the text contains no references to them; the one exception does not give the number of the illustration. And after reading the recommendations for sowing and pricking out, it is surprising to see an illustration of space-sown seedlings. It is a pity, too, that such careless phraseology as "spores . . . on the foliage of such diseases" and "the foliage tends to breathe out or transpire" has been allowed to creep in.

Nevertheless, after making allowance for these faults, *Tomato Growing* is well worthy of the attention of all growers of this crop, and, if only for its down-to-earth approach, should be a valuable asset to many.

J.R.

Teaching Vocational Agriculture. E. W. GARRIS. McGraw-Hill. 52*s.*

This text-book for teachers in training, written by the head of the agricultural education department in a southern University in the United States, must be approached with the agricultural and scholastic background of that country in mind. So different is the system, with its "grades", "majors", "subsidiaries" and "options", its one-teacher schools, consolidated rural and high schools, its F.F.A. (Future Farmers of America) "chapters", and its welcoming acceptance of the vocational in the education of the teenager that much intelligent transposition of key, as well as the complete rejection of whole blocks of the material, seem inevitable for use in Britain.

Nevertheless, county organizers and teachers of rural science may well find it profitable, and even inspiring, to peruse this book, with its detailed treatment of individual farm projects, class inquiries and rural surveys, and School Y.F.Cs, such as it is difficult to "bring alive" in the different set-up of our schools. New angles can be very illuminating, and Dr. Garris's offering has the added attraction of that large American simplicity which, though at times irritating in its naivety and over-simplification, has so often the courage to "have-a-go" and to accomplish largely what it sets out to do. It must be borne in mind that their farming, their education, their social scene, and their whole culture are, after all, newer and simpler than ours. Simplified, step-by-step and stage-by-stage analyses of duties, methods, and requirements, such as this book provides, besides helping the new teacher, may serve to provoke a little self-examination in those aware of a certain staleness. Others may be irritated by their high-sounding polysyllabic phraseology, while yet others may be mildly surprised to learn that they have been doing just these things all along.

Local authorities in the U.S.A. apparently face up much more squarely and calmly than ours to those problems which they share with us, such as, for instance, the large appropriations needed for such work; the need for paid labour on the school farm; the problems of feeding livestock and weeding school gardens during holidays; and the fact that school farms and gardens hardly ever cover costs, particularly if their instructional purpose is to be fully met.

F.E.K.

The Daffodil and Tulip Year Book, 1955. Royal Horticultural Society. 10*s.*

Whether he is a grower of dry bulbs for the retail trade, a producer of bulb flowers for market, an amateur enthusiast whose highlights of the year are the spring daffodil shows, or a breeder of new varieties of bulbs, the man interested in daffodils and tulips will find much to interest him in the new edition of this well-established annual.

Attractively produced and in good time for the coming bulb season, this publication is, despite its title, largely devoted to the cult of the daffodil. The subjects of the two dozen or more articles range from Ireland, where so many of our new varieties are bred, to New Zealand and Tasmania, where the delicate new pink varieties are so popular. The Isles of Scilly, the Midlands, the United States and the London shows all receive attention, but there is no news this year from our greatest competitors in bulb production—the Dutch—and nothing from Holland in England, where so many bulbs are grown.

Guy L. Wilson, that doyen of daffodil breeders, contributes at length. His note on "Recent Developments in the Breeding of White Daffodils" contains much of the wisdom of years of interest and success in this his especial hobby. Those who think of the many pale varieties as weak and not typical of these yellow spring flowers will be stirred by the obvious enthusiasm and knowledge displayed in this article. The same writer's notes on the 1954 season are the journal of a man bent on seeing the flowers he lives for in all parts of the country, while still attending to the production and exhibition of his large collection of new varieties. In it is much that will help any who think of breeding or showing daffodils as a business or hobby.

For the strictly commercial grower the annual Daffodil Ballot conducted by the Royal Horticultural Society gives a good indication of how public taste is tending in the various sections in which the varieties are grouped. Varieties for cutting, for cutting for market, varieties for forcing and for bowls, and those for exhibition were voted on by twenty-two specialists in close touch with all aspects of the requirements of their customers. Similarly, the accounts of shows in many parts of the country and overseas indicate which are the successful varieties and, thus, which can be expected to be in demand among exhibitors and the more discriminating amateur buyers.

Cyril F. Coleman's Public Ballot indicates what those attending the R.H.S. Daffodil Show in London thought of nine widely differing varieties representative of the main sections into which the thousands of varieties are placed. More than sixty new names are listed which have been added in the past year, but only six of the thousands were considered by the Society to be outstanding for exhibition, and only three of those which are being tried at Wisley were similarly chosen for their value for garden decoration.

Two chapters on new tulip varieties and on the cultivation of tulips are of great interest and value to those who continue the vogue for a flower which was once popular beyond the dreams of present-day growers.

Notes on the 1954 season by growers and experts in various parts of the world help to fill a valuable miscellany which anyone interested in this branch of horticulture will almost certainly wish to possess.

F.W.S.

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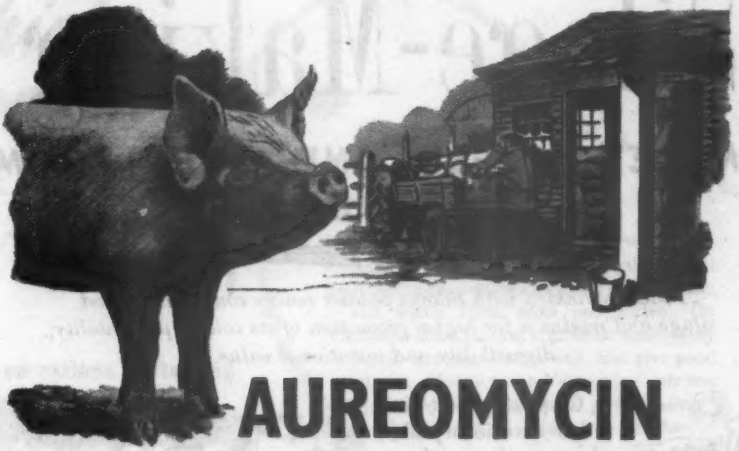

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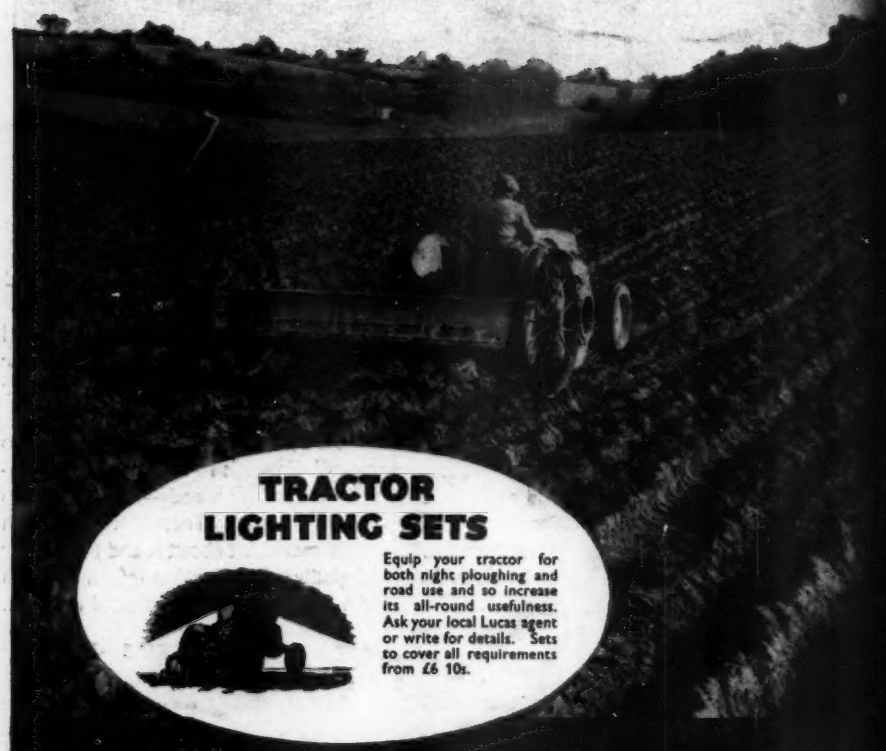

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